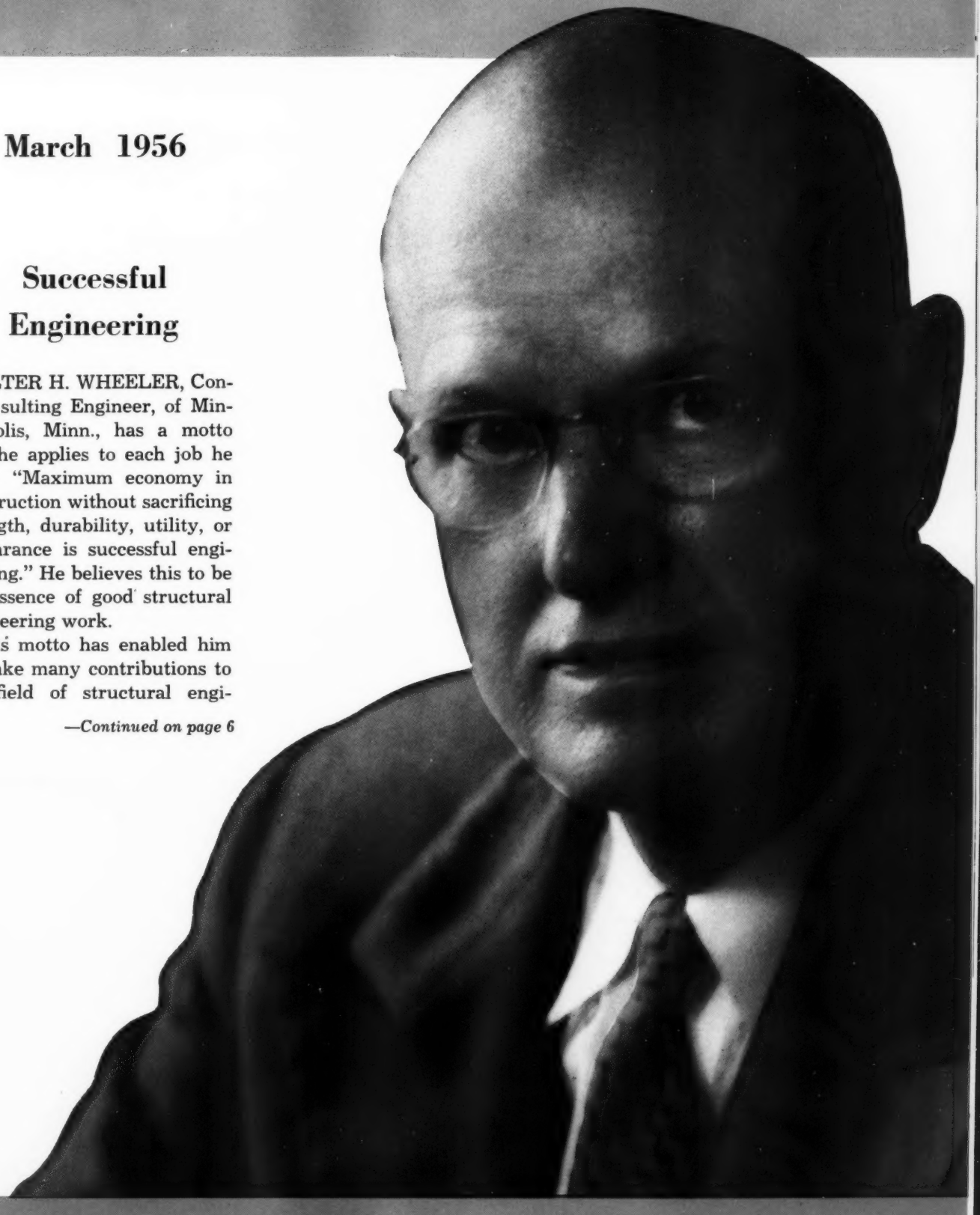
consulting engineer



March 1956

Successful Engineering

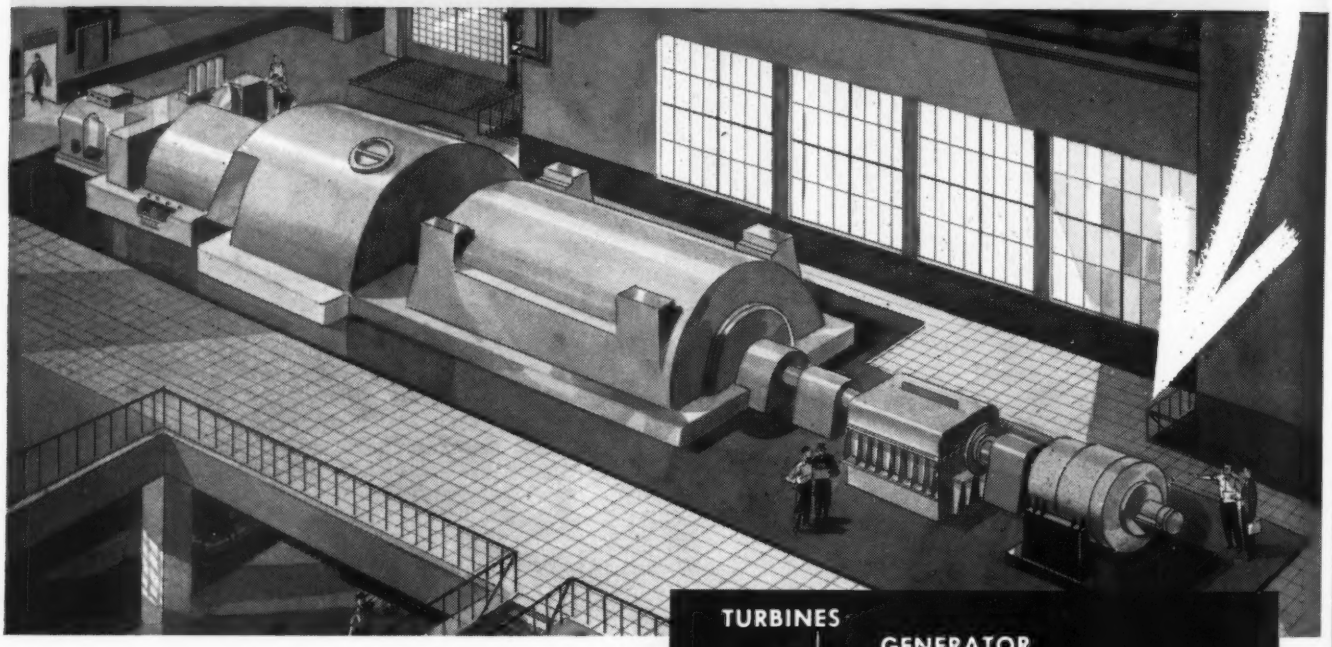
WALTER H. WHEELER, Consulting Engineer, of Minneapolis, Minn., has a motto that he applies to each job he does: "Maximum economy in construction without sacrificing strength, durability, utility, or appearance is successful engineering." He believes this to be the essence of good structural engineering work.

This motto has enabled him to make many contributions to the field of structural engi-

—Continued on page 6

The Consulting Engineer's Professional Magazine

Byron Jackson makes history with World's Largest Boiler Feed Pump!



Byron Jackson is building the world's largest double case, high pressure boiler feed pump. According to BJ engineers, this pump will be at least twice as large as any boiler feed pump now in existence in the world. This huge unit—rated at 12,000 hp—will deliver 6,330 gallons per minute of feed water against a total dynamic head of 6,400 feet, or approximately 2,700 pounds per square inch at an operating speed of 3,510 rpm. It is being built for the Consolidated Edison Co. of New York, Inc.

A modification of the Byron Jackson-originated double case barrel type feed pump, the unit will consist of a cylindrical outer barrel and cover enclosing a horizontally-split inner volute case. The double volute design, together with back-to-back mounting of the impellers, provides for quick, uniform heating and reduces axial and radial thrust to a minimum.

UNIQUE DRIVE SYSTEM

For this BJ super pump, power company engineers are employing an altogether new concept of drive, the main generator steam turbine. Power is transmitted through an American Blower Corporation fluid drive coupling for variable speed operation to meet all load conditions.

To provide trouble-free operation, BJ engineers will incorporate packless type stuffingboxes with controlled leakage as well as a rotating element of rigid construction, limiting shaft sag to about one-third of the wear-surface clearances. Amazing as it may sound, this pump could be run dry.

ANOTHER BYRON JACKSON "FIRST"

This pump represents one more pioneering step undertaken by Byron Jackson in its long history of designing rugged, trouble-free pumps for any service.

BJ

Byron Jackson

Division of Borg-Warner Corporation
P. O. Box 2017A, Terminal Annex
Los Angeles 54, California

VOLUME 7 NUMBER 3

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March 1956

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Walter H. Wheeler

—Starts on front cover

neering. He made the preliminary investigation and engineered the largest multiple rib arch reinforced concrete bridge — the Fort Snelling-Mendota bridge over the Minnesota River, ten miles out of Minneapolis, Minn. While a partner in the engineering and construction firm of Jones, Wheeler, Cranmer Engineering Co., of Denver, Colo. (1908-1912), he designed Denver's first skeleton frame reinforced concrete building. This type of construction was so new at that time that a building permit was not issued until after the building was completed and had proved that it would not collapse. The first continuous girder bridge with piers hinged at the bottom was designed by Wheeler to span the Zumbro River at Rochester, Minn.

Experience with Flat Slab Construction

He has also made contributions in the field of earthquake resistant structures. He was consultant on design of the Y.M.C.A. dormitory in Honolulu — of flat slab construction with a single span of 29 ft — and designed the Paulsen Building and the Publishers Building, both in Spokane, Wash.

Wheeler's experience on reinforced concrete and structural steel buildings led him to invent the "Smooth Ceilings" system of flat slab construction in which the steel column heads or grillages, prefabricated by welding, are embedded in the slabs, eliminating drop panels and flared column caps. The Grace Street Parking Garage, Richmond, Va., with 23-ft flat slab cantilevers, for which Wheeler served as structural engineer, is an example of this type of construction.

A graduate of the School of Mines of the University of Minnesota, in 1906, Walter Wheeler soon found his main interest to be in the field of structural engineering, and he is today a registered professional engineer in Minnesota and eight other states, a member of the American Society of Civil Engineers and the American Concrete Institute, and a past president of the Minnesota Association of Consulting Engineers. He educated himself in civil engineering by reading and by attending night classes.

The Engineer as a Student

"An engineer has to be a self starter. When I graduated from school, I went into the contracting business. I soon learned that to get ahead I needed further information on some phases of engineering that had been only touched on in school, and that no one but myself was going to see that I got this education. In night school I also took courses in such subjects as contract law and economics.

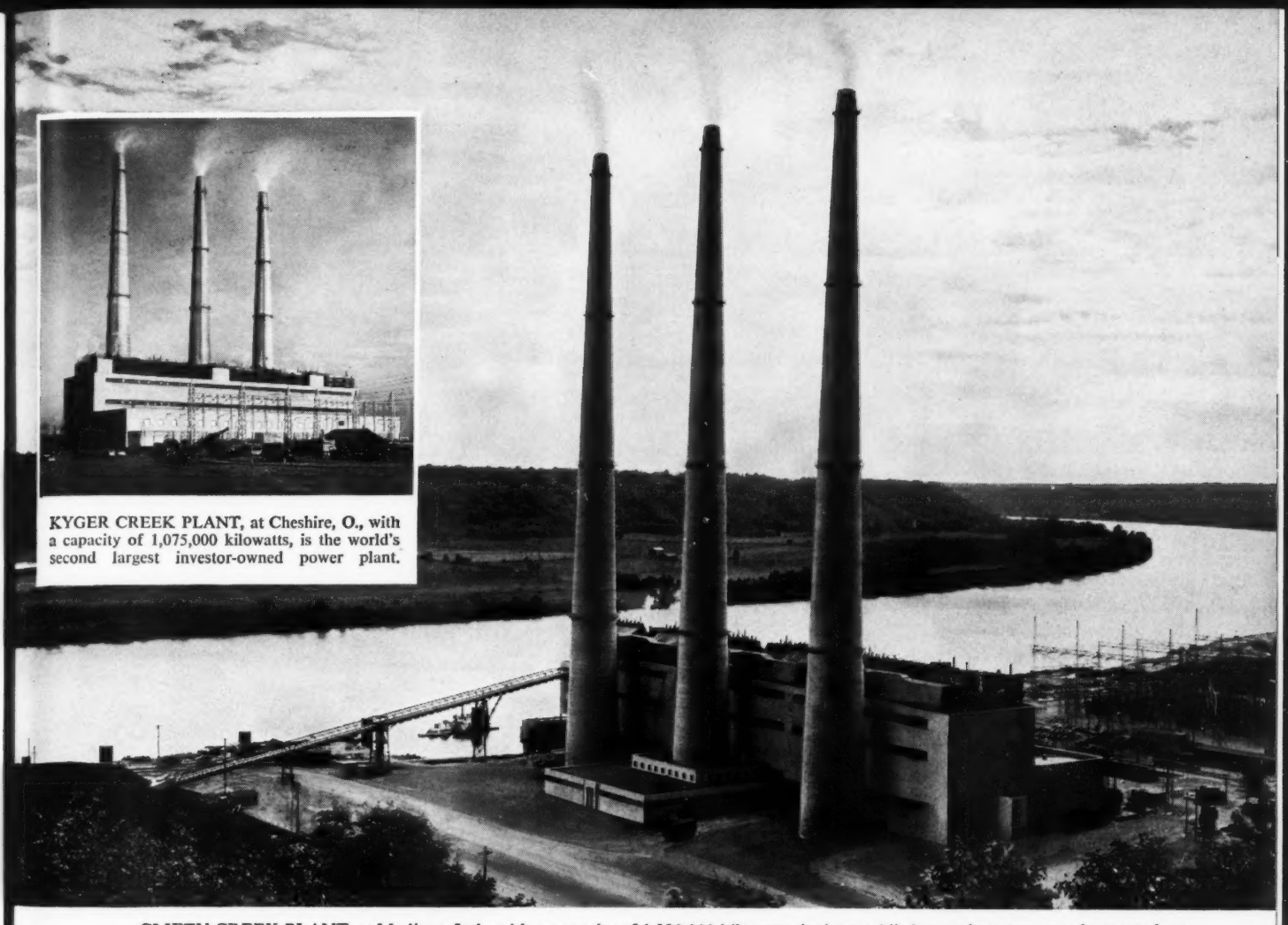
"The education of engineers has many interesting facets. Too many of our engineering schools today are turning out mechanics instead of engineers. This type of technician is never going to gain professional recognition. The engineering student must have a broad base on which to build his future career. He should be made aware of the political, sociological, and economic problems of the world so that he appreciates his obligations. On the city and state government committees on which I have served, the engineer usually has been conspicuous by his absence. Until the engineer accepts his responsibility to his city, state, and country—as do the lawyers, clergy, and doctors — he cannot be recognized as a professional man.

The Engineer as a Citizen

"In 1945-46, I was national chairman of the Committee on Education of the National Society of Professional Engineers. We recommended that an engineering degree be granted after five years of college work and that 20 per cent of the time in school be spent on the humanities. You can't expect to teach a man all about engineering in school, so why not give him a good solid grounding in the fundamentals of mathematics and the sciences and teach him to be a good citizen. To be a good engineer he must continue to study under his own power after he leaves school. Our proposals have been adopted by a number of engineering schools. One of the first to revise its curriculum was my *alma mater,* the University of Minnesota.

"An engineer's education is never completed. Look at the new developments in the structural field. High strength bolts are being used more and more extensively for construction where vibration is not a problem. They must still be proved for such heavy duty use as railroad bridges. Concrete shrinkage is another field in which progress is being made. The work my office has done on this problem indicates that the harmful effects of initial shrinkage can be lessened by proper construction procedures and that long term shrinkage is largely avoided by proper chemical composition and handling on the job. These are things learned by experience on the job and by keeping up with current developments.

"Each new idea advances the art of engineering and brings the engineer closer to recognition as a professional man. These ideas are frequently the result of self education—keeping up with what is being done in all branches of engineering. Education is a continuous process. The engineer in private practice also has a responsibility to his community. His special knowledge and background should be made available to the community, state, and nation. These activities, combined with the motto, 'Maximum economy in construction without sacrificing strength, durability, utility, or appearance is successful engineering,' are essential to success as an engineer in private practice." ▲▲



KYGER CREEK PLANT, at Cheshire, O., with a capacity of 1,075,000 kilowatts, is the world's second largest investor-owned power plant.

CLIFTY CREEK PLANT, at Madison, Ind., with a capacity of 1,290,000 kilowatts, is the world's largest investor-owned power plant.

THE MIRACLE ON THE OHIO RIVER

On the banks of the Ohio, right now, these two huge electric plants are turning out power at the rate of over 18-billion kilowatt-hours annually. They are, respectively, the first and second largest investor-owned power plants in the world. They stand on what was farmland less than three and one-half years ago.

Their completion, substantially ahead of schedule, is the result of the outstanding teamwork of management, investors, engineers, technicians and workers in privately-owned utilities and their suppliers.

The vast power output of these plants, *almost half as much electricity as all France produces,* is ready to assure uninterrupted operation of the Atomic Energy Commission's uranium diffusion center near Portsmouth, Ohio.

When the AEC made its enormous needs known, 15 private electric companies* joined forces to form the Ohio Valley Electric Corporation and its subsidiary, Indiana-Kentucky Electric Corporation. In quick order the 11 gigantic B&W boilers, the turbines, generators, buildings—and all the vast complex of auxiliary equipment—were designed, built and placed into operation.

The first generating units went "on the line" in February 1955. The final unit was put in service in February 1956 at Clifty Creek, marking the largest installation of power in a single project ever made in a 12-month period.

All Americans can be proud of OVEC-IKEC for this great accomplishment. What appears to be a miracle is, in reality, a clear demonstration of what private enterprise and enlightened government, working together, can accomplish for the benefit of the entire nation.

The future will undoubtedly pose many similar challenges. Can they be met? Babcock & Wilcox, like so many other American firms, is pledging its resources in extensive manpower and engineering development programs to guarantee that the answer will be "Yes!"

The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N. Y.

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N-210

ALLIS-CHALMERS Helps Milwaukee

WATER

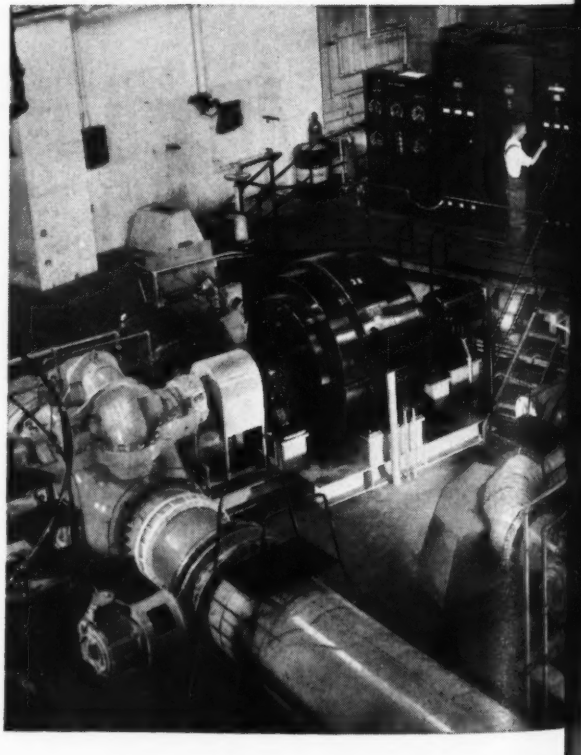
To Keep Pace With Population-Business Growth of Wisconsin's Largest City

IN HUSTLING, BUSTLING MILWAUKEE, water is used at the rate of 175 gallons per day per person. Within the 100-sq-mile metropolitan area of Milwaukee, there are nearly a million people . . . and 2000 thriving manufacturing firms, including world leaders in the production of heavy industrial machinery, beer, motorcycles, tractors, diesel and gasoline engines . . . all using water in increasing amounts.

Milwaukee's water is obtained from Lake Michigan — through an intake over a mile out and 67 feet deep. Consumption climbed from 22 billion gallons in 1924 to 48 billion in 1954. A record month's high — 6¼ billion gallons — was pumped in August 1955.

Allis-Chalmers equipment now operating in Milwaukee's water system includes large vertical pumping engines — dating back as far as 1890 — at the North Point station, and steam and motor-driven units, electrical equipment and valves at the Riverside station, filtration plant and booster stations. In 1955, as part of a continuing modernization and expansion program, two A-C 30-mgd, motor-driven pumps, with controls, substation and butterfly valves, were put into service at the Riverside station.

When YOUR CITY plans expansion or modernization, do as other progressive communities are doing — call the nearest A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin. A-4856



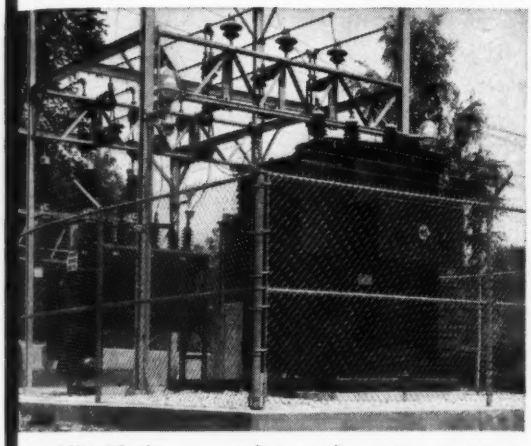
Builders of World's Widest Range of Public Works Equipment

Pumps; motors, *Texrope* drives, control; switchgear, substations, transformers; butterfly valves; steam turbine-generator units, condensers, hydraulic turbines and generators, engine-generator units; blowers, compressors, vacuum pumps; dryers, screens, mills, sifters; tractors, graders, scrapers, motor wagons, power units.

ALLIS

Milwaukee Journal Photo

Modernize and Expand Water Works

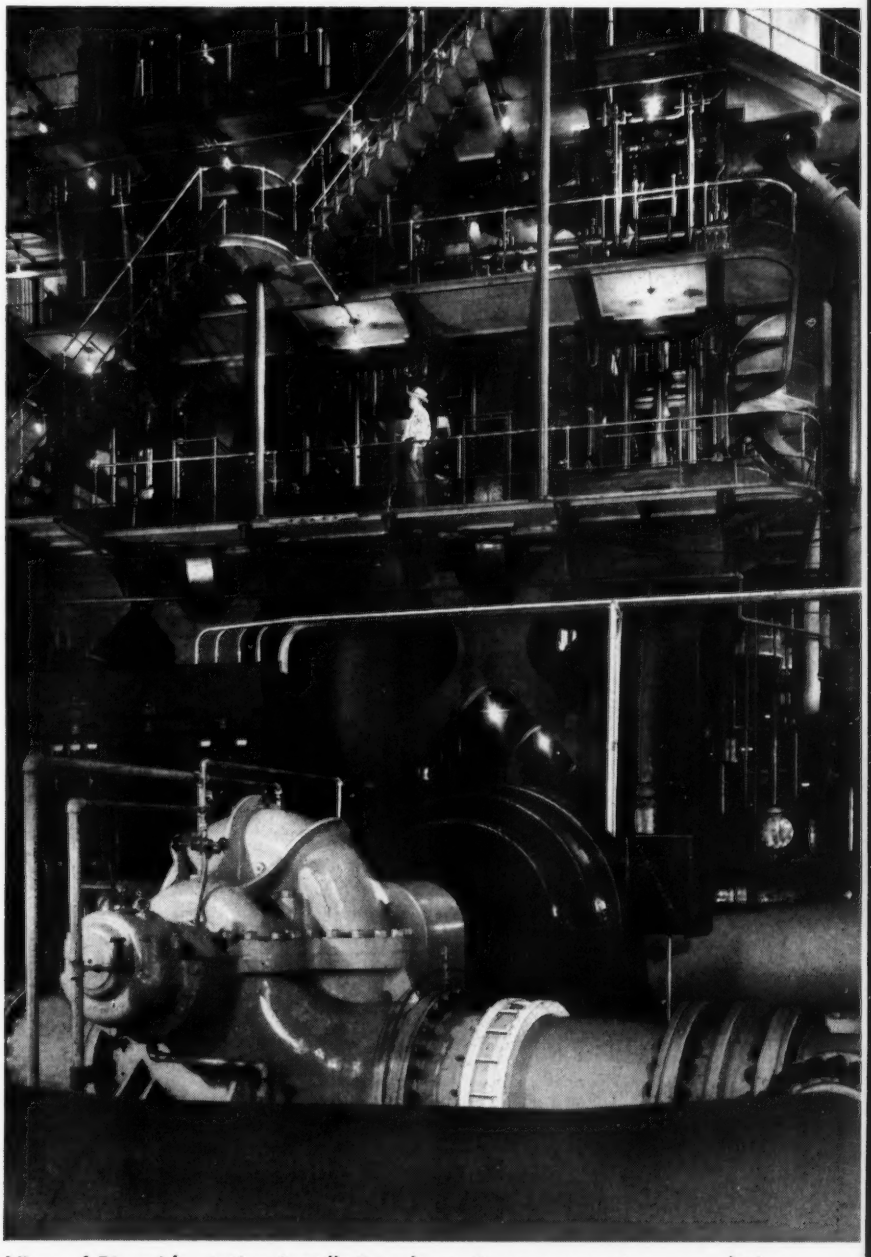


Allis-Chalmers outdoor substation protects and controls the electrical power supply for Milwaukee's Riverside pumping station.

Close-up showing one of several of the latest Allis-Chalmers butterfly valves installed at the Riverside station. A-C builds many designs of valves, including units conforming to American Water Works Standards.

Two new Allis-Chalmers 30-mgd pumps and their 2000-hp synchronous motors and controls were fitted into space formerly occupied by one 30-year-old, 15-mgd vertical pumping engine.

Texrope is an Allis-Chalmers trademark.



View of Riverside station installation dramatizes progress in pump design in the past 30 years. Towering pumping engine in background was record setter in 1924 and is still going strong. But at best it pumps only two-thirds of the water handled by compact new A-C pump in foreground.

CHALMERS

A-C ALLIS-CHALMERS

The Reader's Guide

Few people get really tax-conscious until March or April. By that time, it is too late to change the facts . . . too late to do anything about taxes for last year but pay them. By now you should have been thinking about 1956 taxes for at least three months, and if you haven't, this is a good time to start. Most consulting firms are partnerships, and as such do not have to pay taxes on income even though informational returns have to be filed. This does not mean, though, that taxes are no problem. There are ways of saving tax money for partners, as individuals, and there are a lot of intricacies that should be understood if you would face April 15 of each year with a smile. It will pay to read carefully the article in this issue of CONSULTING ENGINEER, "Your Partnership and the Tax Law," by Eli Gerver, CPA.

Another article in this issue, "Higher Voltages for Commercial Buildings" is one of those pieces of writing we particularly like because it recognizes the fact that electrical engineers are not the only ones interested in electricity. The actual fact is that the mechanical and the structural engineers are just about as interested in new ideas for electrical distribution as the electrical expert. The distribution system is, after all, an integral part of the project, not a factor that can be considered separately from mechanical equipment or structural design. This article is written in such a way that any engineer can understand it, yet it contains new information that will be welcomed by the most enlightened of the well-read electricals. Besides, it deals with money . . .

An article coming up in April also proves the value of one engineer knowing what the other fellow is doing. Harold McConnell, the author, is a consultant in Houston, Texas, and his field of specialization is electrical. But as with most consultants, he seems to get more jobs outside his specialty than in it. Here lately he has been doing a lot of heating and air conditioning work. As an electrical engineer he was most familiar with the mathematical methods used in electrical network analysis, and it occurred to him that the same approach might be used in analyzing piping systems. To him the pipes became wiring, the pressure became voltage, and the flow of water became the equivalent of electrical current. He applied the equations used in network analysis, and he found he could quickly determine the economical pipe sizes, pump specifications, and heat exchanger dimensions for a heating system.

To go backward in time a little, there was a totally inadvertent error made in our bindery when working on the January issue. As close as we can estimate, a little over a hundred copies were mailed with pages 71-74 missing. So far, 34 readers have written asking that we supply them with the missing four pages. We think that is a good percentage to actually write and ask for the missing form. One of them accused us of making the error on purpose just to see how well CONSULTING ENGINEER really is read. That was not the idea, but now that it happened we are glad that we know there are some who care. Once last year we got a copy of *Life* with two similar inserts of cave men in color—and the next eight pages missing. We quietly cursed Henry Luce but never got around to writing him about it.

The Consulting Engineer's European Tour now looks like a sure thing. The interest this tour has created is surprising. It looks as though we will have between 30 and 50 consulting engineers with us in Europe during May. We will be visiting five countries and having sessions with the most outstanding of the local consultants at each stop. Want to go along?

BEFORE YOU BUY A PACKAGE BOILER

CHECK THIS LIST!

If you need a package boiler, the list at the right can give you some interesting answers. Of course, C-E's Type VP Boiler rates a "yes" answer to every question. It offers also many other operational advantages, such as simple, effective soot blowing; high heat absorption; low draft loss, no dead gas pockets and simple baffle arrangements.

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Have full details on the VP next time you are in the market for a boiler of moderate capacity. Get the new Catalog VP-258, which contains specifications, and information on dimensions, construction details and controls. B-845A

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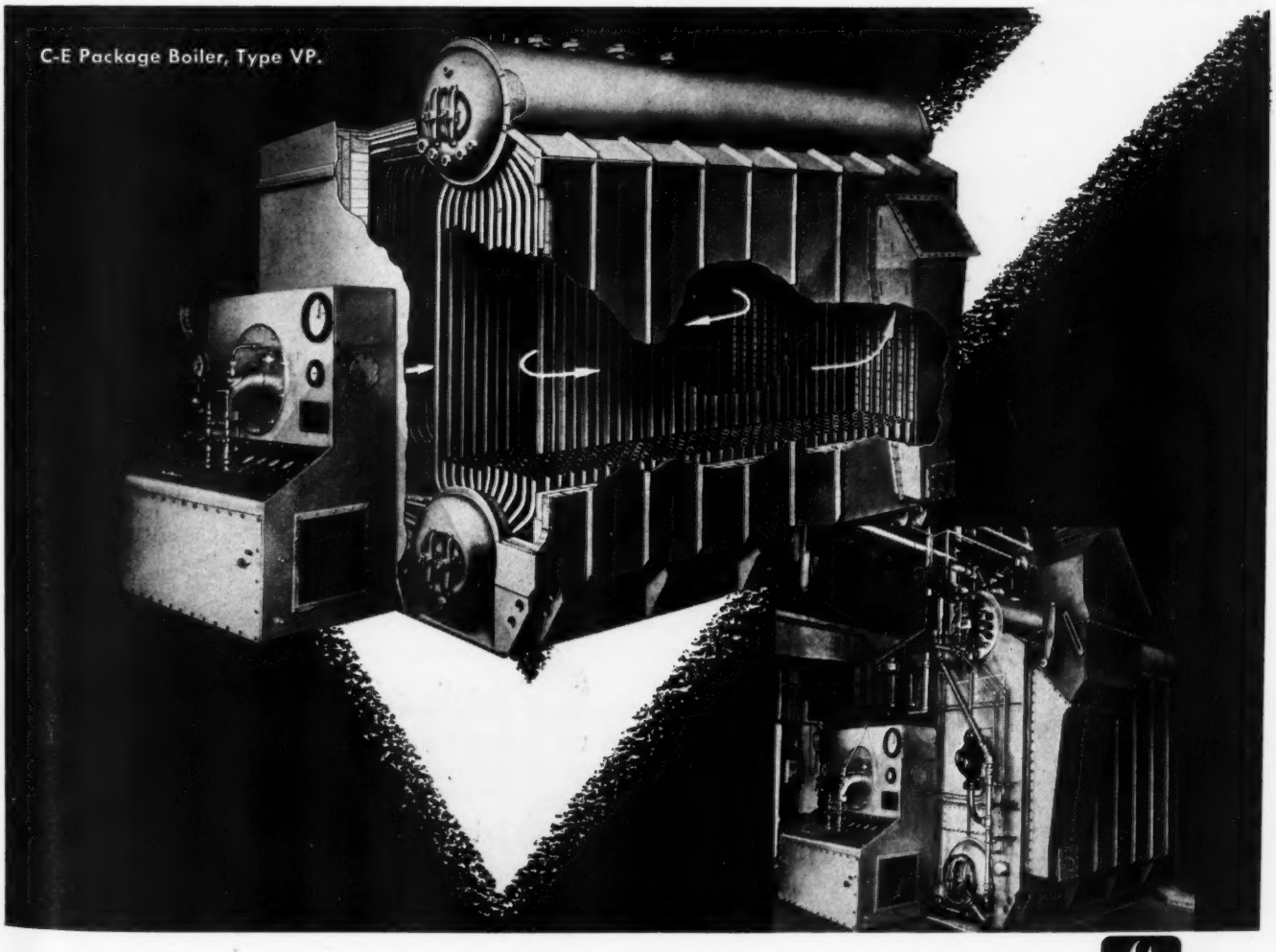
Will your boiler be a real "package" type with control panel and all controls mounted integral with the boiler?						
Will your package boiler be equipped with drum internals to assure dry steam?						
Will its "steam quality" be backed with a guarantee?						
Will your boiler have a 30-in. lower drum to provide convenient accessibility?						
Will yours be a one-burner boiler, with a simple wiring and control system?						
Will your boiler have the largest load swing range available?						
Will your boiler be equipped with a quiet centrifugal fan?						
Will your furnace be *completely* water-cooled?						
Will your furnace have the highest ratio of water cooled surface to furnace volume?						



C-E Package Boiler, Type VP.

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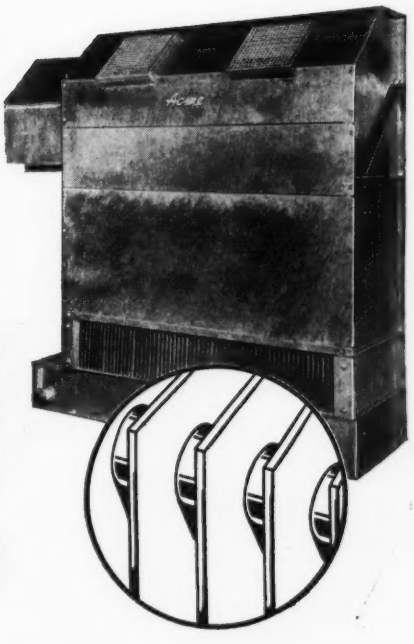

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Wherever you want the efficiencies and economy of water cooled condensing, you can do the job best — with water savings of 95% or better over ordinary consumption — by specifying an Acme Flow-Mizer Evaporative Condenser or Cooling Tower. You'll gain the advantages of field-proven Acme design . . . of ratings and application data you can rely upon implicitly. New information-packed catalogs are yours for the asking. Use the coupon below today.

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READERS' COMMENT

Income Tax

Sir:

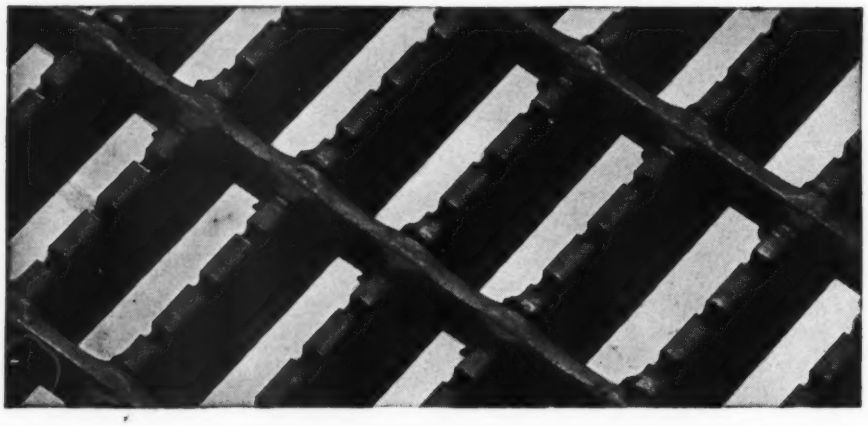
. . . it has appeared to me that something which persons engaged in professions ought to give more attention to is the matter of being properly represented before the House Ways & Means Committee and other tax committees in the matter of income taxes.

What I have in mind here is that it is well known that persons who are already well off can invest their funds in tax exempt securities. By doing so, they receive a considerably lesser yield than they would if they invested in stocks, but, as I understand it, the loss is only equivalent to something like a 45% tax. On the other hand, professional men, or for that matter corporation executives, artists, writers, performers, and in general all who receive an income in return for services, have to pay the full tax, and considerably more than 45% in the higher brackets.

It can be advanced that this is unfair, but beyond this it can be argued that it is socially undesirable, because presumably if our capitalistic society is to operate effectively it would seem to be advantageous to all that persons of ability, as demonstrated by earning power, should be placed in a relatively favorable rather than a relatively unfavorable position to acquire capital.

The social argument here is that the capable person with earning power would probably make use of the capital he acquires in a more efficient and socially useful way than the person who merely inherits money.

Robert H. Park
Consulting Engineer and Physicist
Brewster, Mass.



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Standard Steel Spring Division
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For a National Federation

Sir:

Results of the survey you conducted are most interesting and I am extremely optimistic about building our Consulting Engineers' organization into a strong working association.

We are very much interested in securing the names of potential members of new associations of consulting engineers. Would it be possible for you to furnish such a list to us so that we can do some missionary work? We would be happy to do the research work ourselves if we had the questionnaires to work from. If you could supply this information, we certainly would appreciate the opportunity to go to work with it.

Hueston M. Smith
Vice President
Missouri Association of
Consulting Engineers

• SUCH LISTS HAVE BEEN PREPARED BY T. E. ROCHE OF THE MINNESOTA ASSOCIATION OF CONSULTING ENGINEERS, AND THESE LISTS OF PROSPECTIVE MEMBERS HAVE BEEN SENT TO ASSOCIATION SECRETARIES.

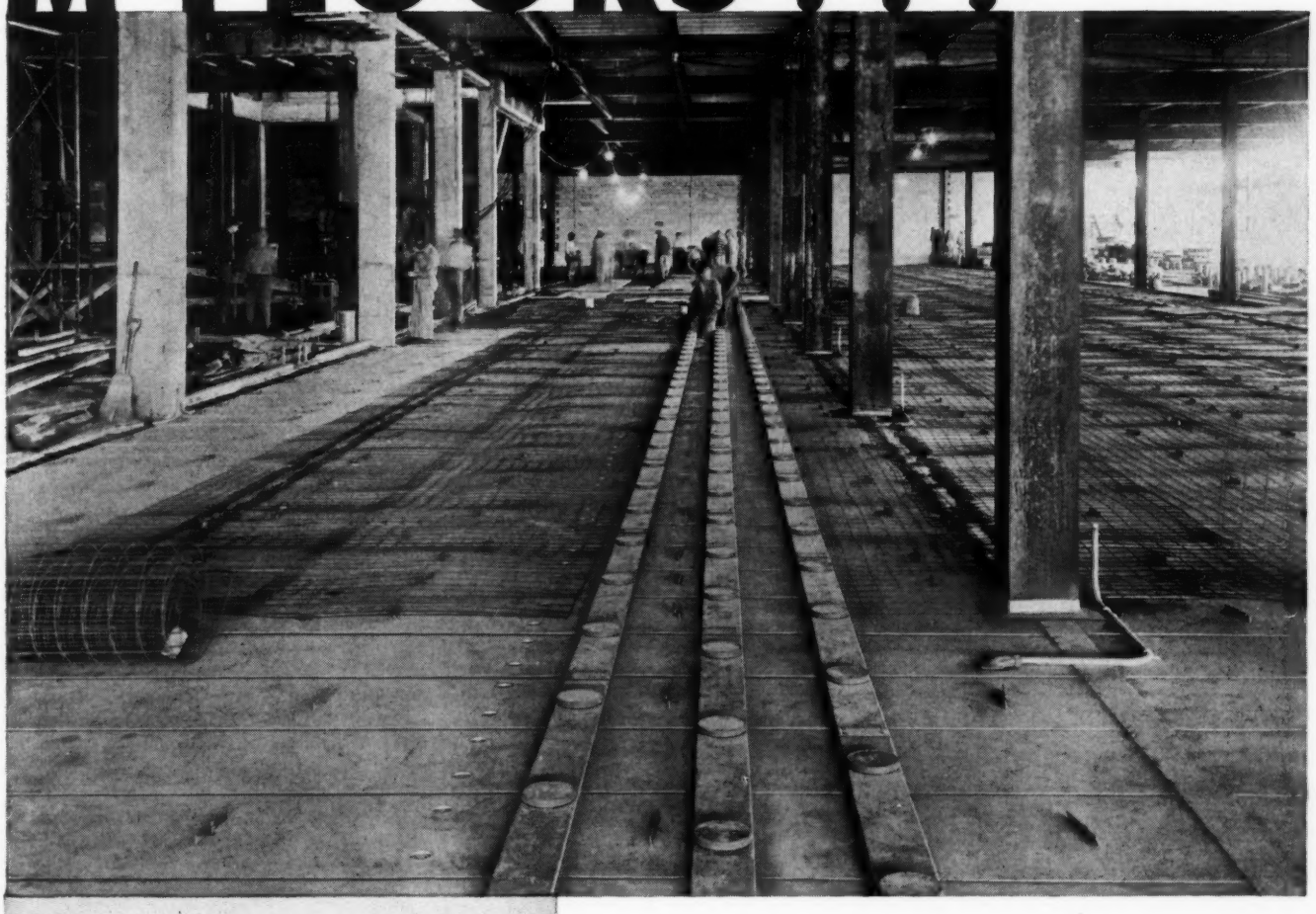
Sir:

I have read with considerable interest the results of the survey of consulting engineers' opinions in regard to the formation of associations to represent them.

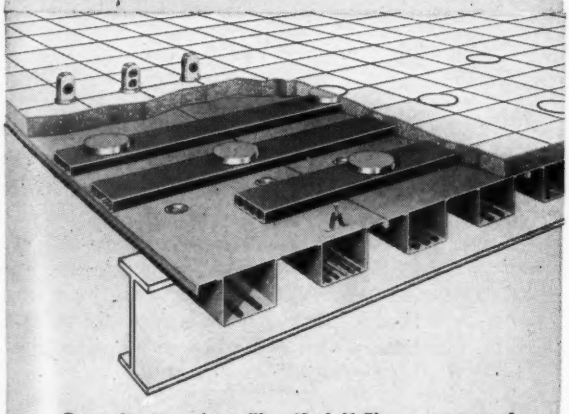
The overwhelming interest expressed by the answers to Part 1, Question 2 (76.2 percent favored formation of a national association) are most encouraging and indicate very clearly the nation-wide support for the proposed National Federation for which our Steering Committee is now drafting a constitution.

Our committee is greatly heartened by this indicated support and we sincerely hope that further local

M-FLOORS . . .



Provide Electrical Availability in Every Sq. Ft. of Floor Surface



Cross Section of an Electrified M-Floor constructed with Mahon M-Floor Section M2 and energized with a Three Header Duct Electrical Distribution System. M-Floor Cel-Beam Sections are available with either Two or Three 6″ wide Cel-Beams in a 24″ width, and with One Cel-Beam in a 12″ width.

. . . more important, Cel-Beams in electrified M-Floors provide the unlimited built-in raceway capacity which insures a building against electrical obsolescence in years to come. When you have decided on Cellular Steel Floor Construction, call in a Mahon engineer and have him show you the many advantages engineered into the design of M-Floor Cel-Beam Sections. You get a higher Section Modulus with less weight in M-Floors . . . Cel-Beams are wide enough to permit 4″ diameter access handholes between Electrical Header Ducts and Cel-Beam Raceways, yet they are narrow enough to provide adequate and evenly distributed beam web support for the top plate. These are important features . . . features which have direct and far-reaching effects not only on initial building costs, but also on the cost of any subsequent additions or changes in electrical and communication circuits throughout the life of the building. Get the facts before you select a particular Cellular Steel Sub-Floor for your next building. See Sweet's Files for complete information, or write for Catalog M-56.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York and Chicago • Representatives in Principal Cities

Manufacturers of M-Floors (Electrified Cel-Beam Floor Systems), Insulated Metal Walls and Wall Panels, Permanent Steel Floor Forms, Steel Roof Deck and Long Span M-Decks, Rolling Steel Doors, Grilles, and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Fire Shutters.

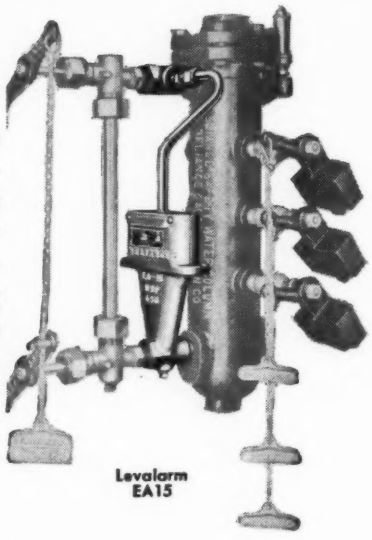
MAHON

Tiny currents guard boiler safety

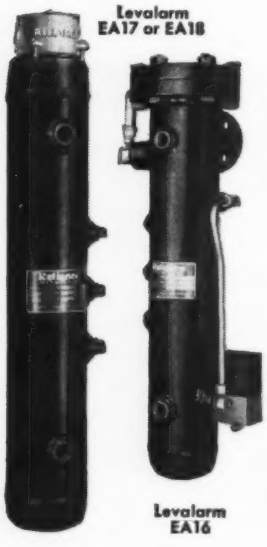
You can operate alarms, fuel cut-out, start and stop pumps safely and accurately with

Reliance Levalarms®

Now you can protect any boiler, from lowest pressures to 2500 psi, with a completely electrical fast-acting alarm system and other controls. Actuated by a tiny current — 25 milliamperes or less — relays pick up signals through the opening or closing of isolated electrode circuits installed on or in the boiler water column. Levalarms are unaffected by pressure, temperature or water conditions.



Levalarm EA15



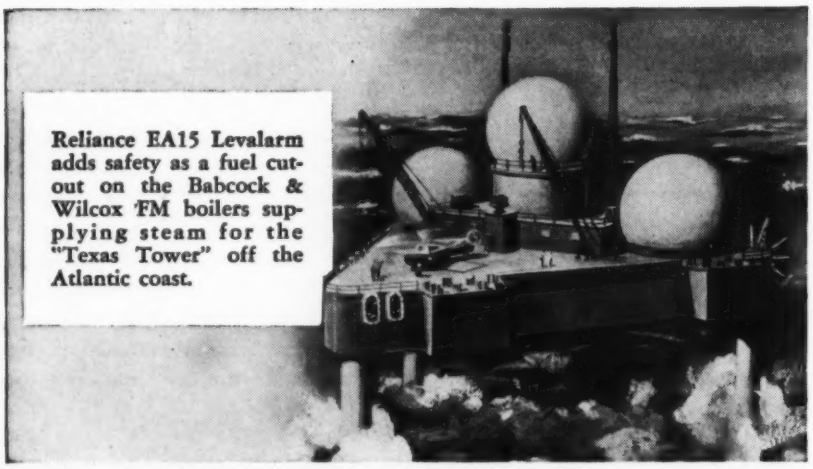
Levalarm EA17 or EA18

Levalarm EA16

Low alarm or high alarm or both, fuel cut-out, and starting and stopping of pumps thus are affected with the speed of electricity *within a small fraction of an inch* change of the boiler water level at predetermined safety points.

The simplest of four Levalarm models, shown above, is a fuel cut-out on a water column. Other variations are for higher pressures and wider variation of control combinations. For the full story about these new Levalarms, write for Bulletin D2.

The Reliance Gauge Column Company
5902 Carnegie Ave. Cleveland 3, Ohio



Reliance EA15 Levalarm adds safety as a fuel cut-out on the Babcock & Wilcox FM boilers supplying steam for the "Texas Tower" off the Atlantic coast.

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

associations of consulting engineers will be in existence by the time the National Federation is launched, which we hope will be in about three months.

John K. M. Pryke, President
New York Association of
Consulting Engineers

Sorry

Sir:

The writer has been anxiously awaiting the report covering results of the survey ("What the Survey Said," Jan. CE, p. 56) which you recently conducted. You can imagine my disappointment when the January issue of your magazine was received and pages 71 through 74 were missing, because these pages apparently carried a good portion of the survey, together with any summation you might have had. A group of consulting engineers within the North Carolina Chapter of N.S.P.E. has been discussing the problem which your survey covered and we are very interested in knowing what engineers in other states are doing.

I would like to have a half dozen copies of the report if you have these available as reprints of the magazine article.

Thanking you for your attention and complimenting you on a fine magazine, I am

W. P. Wells, Treasurer
Professional Engineers
of North Carolina

Homework

Sir:

I wish to notify you of my change of address in employment. Since I find little or no time to read CONSULTING ENGINEER in my office, I would prefer to have it mailed to my home address...

I take this opportunity to mention that I thoroughly enjoy the many timely articles appearing in this magazine.

Joseph L. Baruzzini
Smith-Hanlon-Zurheide-Levy
St. Louis, Mo.

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 227 Wayne St., St. Joseph, Mich.

INSIDE STORY:

Why a Heat Exchanger Poses for an X-ray

This technician is giving a clean bill of health to a completed weld on a P-K heat exchanger. Like the x-ray of your chest, this x-ray picture is designed to pick up flaws before they have a chance to become harmful.

Pinholes, lamination, slag inclusions, and all other symptoms of failure are ruled out by this process, which is used to scrutinize the "inside" of *every weld.* Such radiographs are indispensible in manufacturing pressure vessels that will meet every test of time and use. Each x-ray is checked by a representative of the Hartford Steam Boiler Inspection and Insurance Company —for further insurance that every P-K heat exchanger meets or exceeds the rigid standards of the 1952 ASME Code for Unfired Pressure Vessels.

But weld x-rays at P-K represent only a *precaution.* They don't speak for the fact that all P-K welders are ASME qualified for a total of more than 50 types of welding procedures—meaning that the likelihood that flaws will occur at all is minimized. Nor can you see in an x-ray photo the incredibly careful design and calculation that goes into every P-K pressure vessel, to assure that it will be *thermally* and *physically* correct in every way.

Add this all-important knowledge of thermal design to P-K's fabricating and testing procedures, and you have what makes P-K heat transfer equipment different —and better—than all the rest.

Like proof? We'd be delighted to receive your inquiry. The Patterson-Kelley Co., Inc., 1730 Burson Street, East Stroudsburg, Penna. Offices in principal cities.

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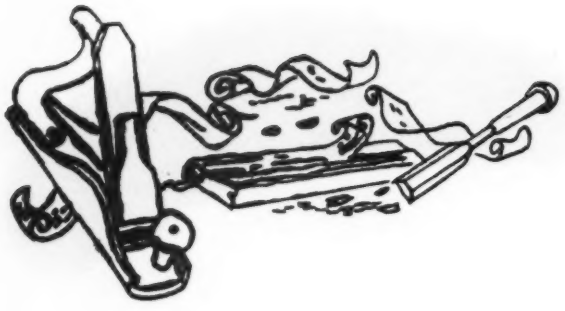


Scraps & Shavings

How Many Legs Has a Dog . . .

THE MEMBERSHIP of the American Society of Civil Engineers has just voted in favor of a change in their "Code of Ethics." Actually, ASCE has two codes of ethics, the "Canons of Ethics" as formulated by the Engineers Council for Professional Development, and their own "Code of Ethics," which in several sections is more specific than the "Canons." The recently voted change applies to Section 4 of the "Code."

In its old form this section reads, "It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers to participate in competitive bidding on a price basis to secure a professional engagement." The amendment would change this to permit engineers competing for professional engagements to state their price when there are reasonable grounds for belief that price will not be the prime consideration in choice among competing engineers.

The reasons for making this change are obvious. About three years ago a number of consulting engineers bid competitively on a highway job in South Carolina. The Board of Direction of ASCE felt this to be an unethical practice under their "Code," and several ASCE members who were involved in this price competition were tossed out of the Society and a few others were suspended for a period of time. This was not a pleasant action to have to take, and it was certainly a source of intersociety controversy. The ethics of competitive bidding on a price basis has been for years a hot potato, and there is no doubt but that this change in the ASCE "Code" is an effort to cool things off a bit.

While the change may make it a bit easier for the Board of Direction of ASCE — in that there will no longer be any necessity for them to expel members who like to bid on a price basis — the basic ethical problem is not changed one whit. It is like the time Lincoln asked his son, Tad, how many legs a dog would have if you called a tail a leg. When Tad answered, "Five," his father explained that actually, he would still have only four legs, because *calling* a tail a leg did not make it a leg. Whether the membership of ASCE calls competitive bidding on a price basis ethical or unethical in their "Code" is not going to change the problem. What ASCE has done is nothing more than remove the problem from the sphere of action of their Board.

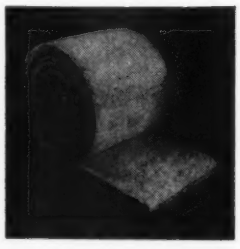
So far as we are concerned, bidding for a professional engagement on a price basis is unethical. It will remain unethical even if ASCE were to remove Section 4 completely instead of just watering it down. No consulting engineer in private practice who is a member of ASCE should consider this change as a license to go forth and bid on a price basis. Instead, he should understand that this is now a problem of personal professional ethics rather than a matter for Society discipline.

There is another interesting aspect of this amendment to the Code of Ethics. There are about 38,000 members of ASCE. Of these, about 4000 members are in private practice or are working for consulting firms. Only these 4000 consulting engineers could be personally interested to any great degree in this amendment. Yet the vote was 12,443 in favor of the change and 1554 against. Obviously the great majority of the voting members were not consultants. In fact it is likely that most of the votes came from users of consulting engineer services, some of whom conceivably might have reason for feeling that there would be a financial advantage if they could get competitive price bids on their projects from consultants.

No one will deny that the only way, and the right way, for ASCE to make a change in their "Code" is through a vote of the full membership, but it is unfortunate that a matter of ethics affecting only consulting engineers should be decided by a group made up primarily of engineers in industry, government, and teaching.

How to kill three duct problems

with one insulation . . .



Thermal, acoustical and vapor barrier problems are "dead ducks" when you use ULTRALITE*, the long glass fiber insulation. Here's why: Due to its unique long glass fiber composition, ULTRALITE is the toughest, most resilient glass fiber insulation on the market, with a record of ten years of successful application. Because of this extra strength, it can be adhered to sheet metal and run through the brakes and shears at the same time the ducts are formed — without worry that it will tear, compress, or delaminate.

Ducts formed in this way are *completely insulated units*, ready to install on the job. They solve the noise problem without impairing the efficiency of the unit because ULTRALITE Duct Liner has a low air friction coefficient. The same insulation that soaks up objectionable sound also insulates the ducts against heat gain or loss. *No vapor barrier is necessary;* with the insulation on the *inside* of the duct, the duct itself becomes the vapor barrier.

Try this time-saving new method on your next job, and you'll be delighted with both cost and performance. But be sure to use ULTRALITE — the only flexible glass fiber insulation with a 10-year record of successful performance.

*Reg. U. S. Pat. Off.

NOTE

Should you continue to wrap ULTRALITE around the exterior of ducts for thermal protection, be sure to line the plenum and short supply and return ducts with ULTRALITE Duct Liner. Do so even on jobs where duct liner is not specified, and you will be well repaid, for this will make all the difference between an enthusiastic and a dissatisfied customer.

ULTRALITE is stocked locally in 57 cities. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon Insulations."

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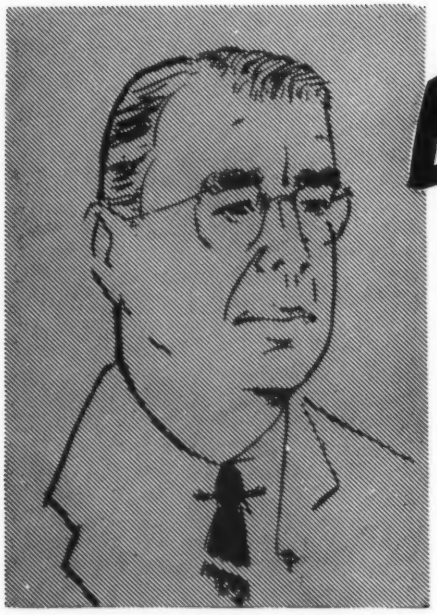


ECONOMIC News Notes

E. F. MacDonald
INDUSTRIAL ECONOMIST

NO LET-UP—Heavy military construction, particularly air bases, will be a major item in building activity for years to come, according to Army and Air Force spokesmen. Lt. Gen. S. D. Sturgis, chief of Army engineers, told a meeting of the Association of General Contractors of America that our world-wide military construction program "doubtless will continue well into the future." On the subject of flood control, he stated that despite work by the Corps of Engineers since 1936, "there is no river basin in the nation where the flood control program is more than two-thirds complete." Maj. Gen. L. B. Washbourne, assistant chief of staff, Air Force installations, added that new equipment and technical improvements should maintain Air Force construction at current rates for the next three to five years.

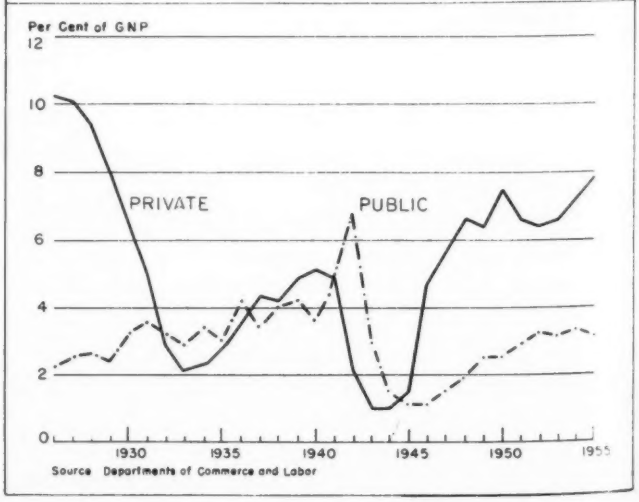
WHAT'S YOURS?—Among the latest crop of suggestions for alleviating or correcting the shortage of engineers are the following: Mr. M. M. Boring, chairman of Engineering Manpower Commission suggests (1) wider use of electronic computing equipment in engineering and research departments, (2) greater employment of women engineers, and (3) greater use of technicians. The recipe of Mr. R. M. Blough, chairman of U. S. Steel is (1) higher salaries, (2) less routine work by engineers, and (3) stressing of "spiritual" reward in attracting young people to the profession. Meanwhile the Richmond, Va., chapter of the Virginia Society of Professional Engineers is tackling the problem at its source. Its members will appear in every junior and senior high school in the city in a program to stimulate interest in engineering.

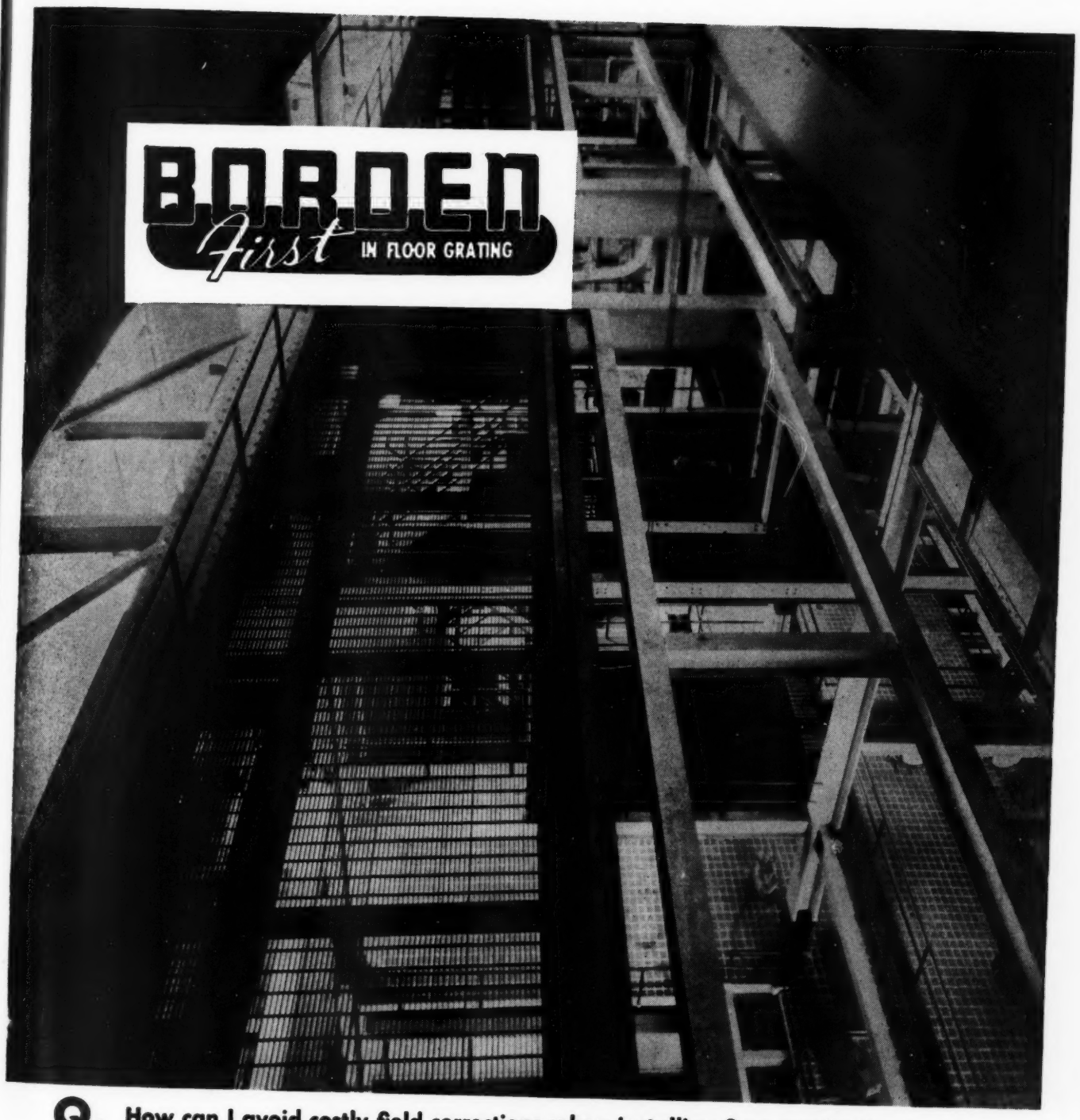
CONSTRUCTION STATISTICS—If Congress approves the President's request, funds will be appropriated for the purpose of improving and expanding statistics on various forms of construction activity. At present, for example, a major deficiency is outlays for alterations and repairs. If Congress provides the money, Government agencies will be able to fill in this gap.

BASIC GROWTH—The world's largest steel plant will be located in Baltimore on completion of present plans by Bethlehem Steel for enlarging its Sparrows Point mill. About $200 million will be spent to add two million tons to the ingot capacity of this plant. It will then have an annual capacity of 8.2 million tons—and able to produce 15 tons of steel every minute.

IN PERSPECTIVE—After a decade of postwar expansion, construction is still a less important component of the economy than it was back in the Twenties. As shown on the chart, private outlays for new construction last year comprised 7.8% of the total spent for all goods and services (gross national product) and public construction accounted for 3.1%. Comparable ratios in 1927 were 10.1% and 2.5%. This is rather surprising in view of the backlog of construction needs that accumulated in the long interim of depression and war during which private construction was cut to the bone. The point could be argued that construction activity has not yet peaked so far as its relative importance in the economy is concerned.

CONSTRUCTION'S ROLE IN THE ECONOMY

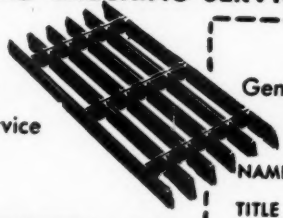




Q. How can I avoid costly field corrections when installing floor grating?

A. SPECIFY BORDEN and receive a completely custom fabricated floor grating including cut-outs, toe plates, fasteners and stair nosings. Be sure with BORDEN: FREE PLANNING AND CHECKING SERVICE.

Write for complete information on BORDEN'S free planning and checking service in this FREE booklet



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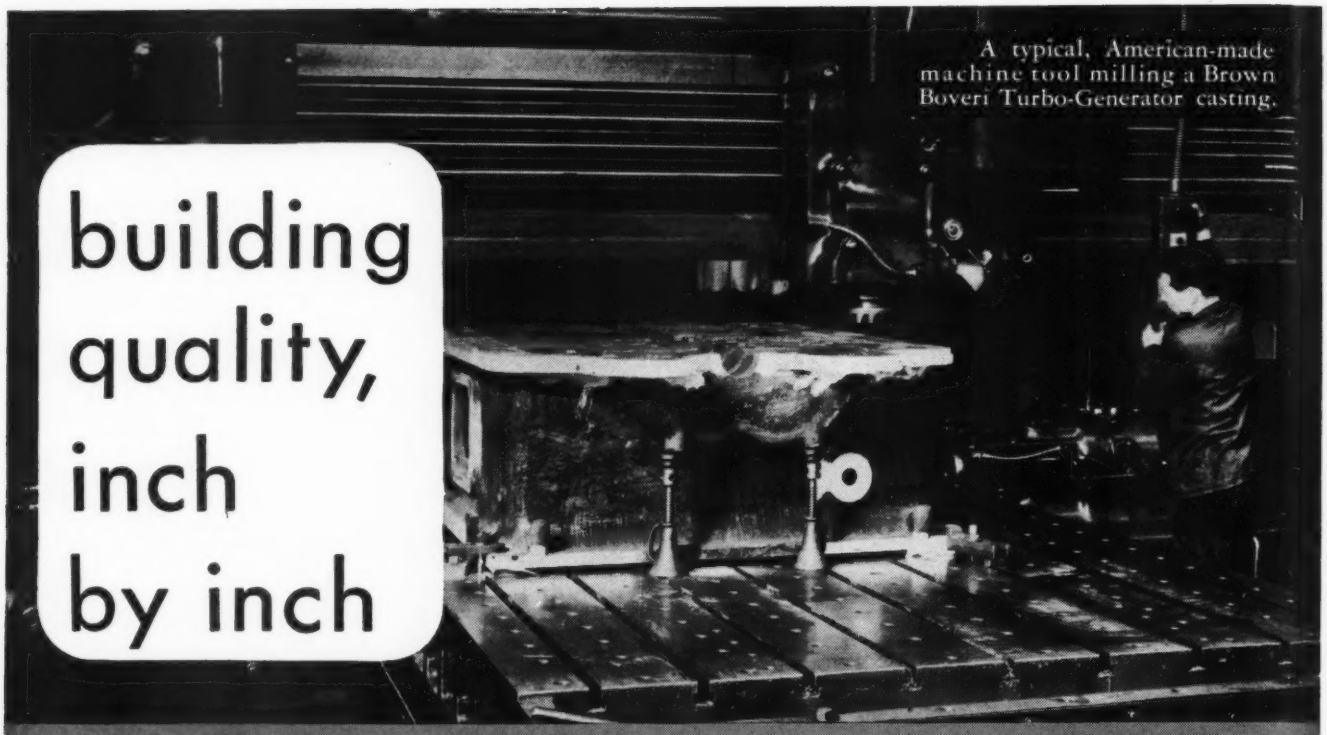

A typical, American-made machine tool milling a Brown Boveri Turbo-Generator casting.

building quality, inch by inch

ONLY Brown Boveri Turbo-Generators have all these basic advantages:

1—Top Efficiency
2—Thorough Dependability
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4—Compact Design
5—Long Life
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All this—and LOWER INITIAL COST, too!

EVERY Brown Boveri Turbo-Generator is *an enduring monument* to the outstanding skills of Brown Boveri engineers and craftsmen. The power generating equipment they design and build is world-famous for quality, and consistent, year-in-year-out performance. In fact, many Brown Boveri Turbo-Generators are still in active service after more than thirty-five years of continuous, daily operation.

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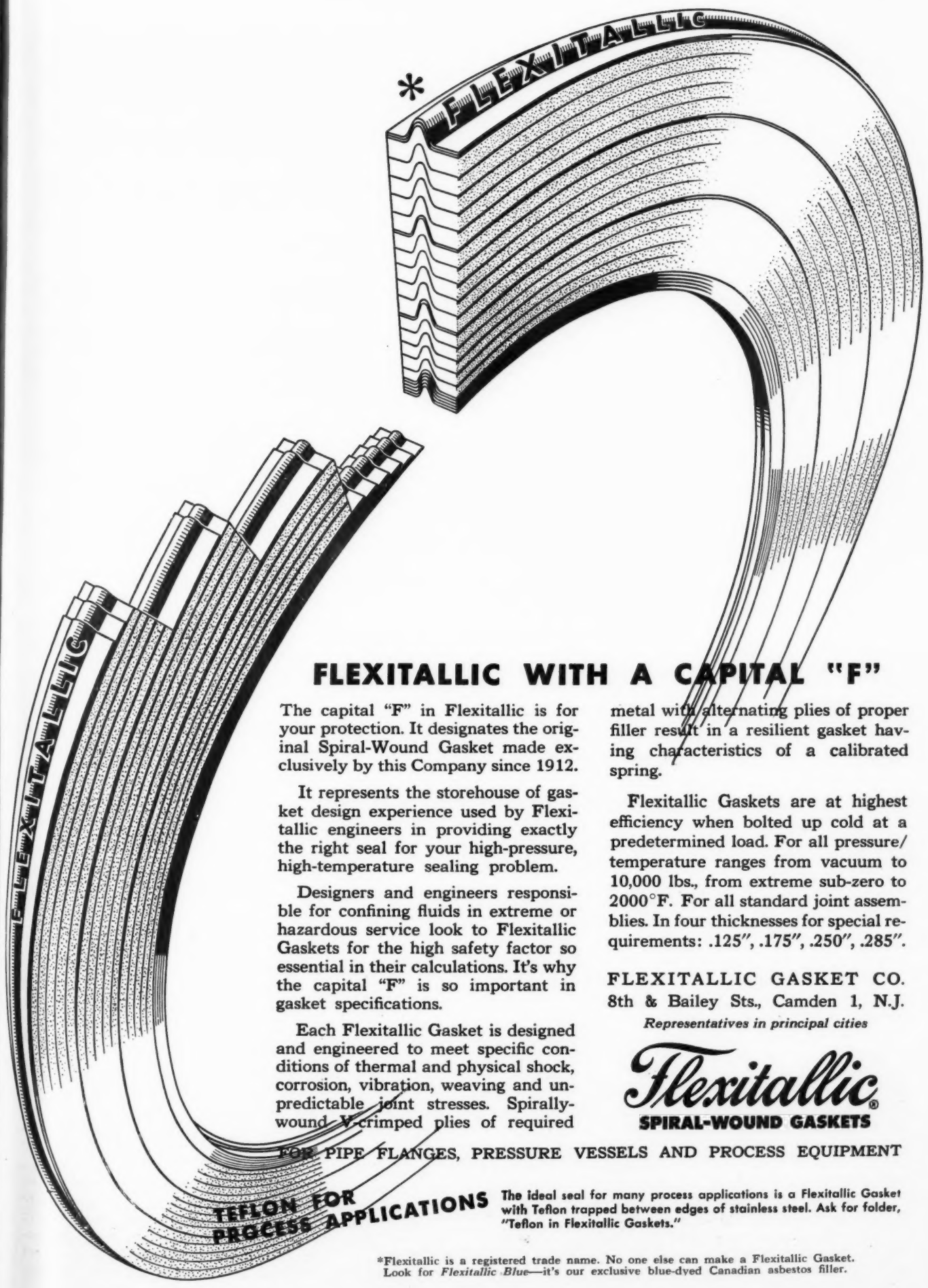

FLEXITALLIC WITH A CAPITAL "F"

The capital "F" in Flexitallic is for your protection. It designates the original Spiral-Wound Gasket made exclusively by this Company since 1912.

It represents the storehouse of gasket design experience used by Flexitallic engineers in providing exactly the right seal for your high-pressure, high-temperature sealing problem.

Designers and engineers responsible for confining fluids in extreme or hazardous service look to Flexitallic Gaskets for the high safety factor so essential in their calculations. It's why the capital "F" is so important in gasket specifications.

Each Flexitallic Gasket is designed and engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having characteristics of a calibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285".

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Flexitallic®
SPIRAL-WOUND GASKETS
FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

TEFLON FOR PROCESS APPLICATIONS

The ideal seal for many process applications is a Flexitallic Gasket with Teflon trapped between edges of stainless steel. Ask for folder, "Teflon in Flexitallic Gaskets."

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

ATOMS IN ACTION

YANKEE ATOMIC ELECTRIC CO. finally has made the grade with AEC's acceptance of its proposal to build a 134,000 kw pressurized water reactor, at Rowe, Mass. As with Power Reactor Development Co. and Consumers Public Power District proposals, Yankee's reactor proposal has been accepted "as a basis for negotiation." All three were submitted under AEC's first-round power demonstration program initiated last year.

ACF INDUSTRIES, INC., of New York, will design and construct the nuclear research reactor for Massachusetts Institute of Technology. With a power of 1000 kw, the reactor will be used for training students in nuclear engineering, and for research in medical therapy, solid-state physics, food sterilization, biology, testing of industrial materials, and engineering of future reactors.

THE POSSIBILITY of sterilizing Los Angeles sewage with nuclear radiation in conjunction with conventional methods of treatment is under study by Nuclear Science & Engineering Corp., under subcontract to Hyperion Engineers. Hyperion, a joint venture of Daniel, Mann, Johnson & Mendenhall; Holmes & Narver, Inc.; and Koebig & Koebig, has been retained by the city to plan improvements in its sewage system. Tests on new techniques, run by NS&E, will form the basis of cost studies to be made by Hyperion Engineers.

THE AMERICAN POWER CONFERENCE, scheduled for March 21-23 at the Hotel Sherman in Chicago, will include sessions on insurance coverage for the atomic industry, and on the roles of government and industry in atomic research and development.

FORMATION OF Power Reactor Development Co., a Michigan nonprofit corporation organized to design, construct, and operate a developmental fast-neutron breeder reactor, has been announced by Detroit Edison Co. The new group is composed of the electric power companies and manufacturers who submitted a proposal for this type of reactor to AEC under the power demonstration reactor program last March. PRD will rely heavily for technical and engineering services on Atomic Power Development Associates, the research and development company formed in 1954.

CONFLICTING VIEWS on the feasibility of an atomic-powered locomotive were evident when Robert E. Wilson, of Standard Oil of Indiana told an American Bankers Association meeting: ". . . can you imagine either the railroads or the regulatory authorities being willing to risk a possible wreck of an atomic engine in one of our cities." While during the same month Senator John Butler and Representative Edward Miller, of Maryland, introduced a bill in Congress "to authorize an appropriation for the development, construction, and operation of an atomic-powered railway locomotive."

THE BUREAU OF MINES has begun tests to determine the possibility of using nuclear heat to produce gas from coal at its Appalachian Experiment Station in Morgantown, W. Va.

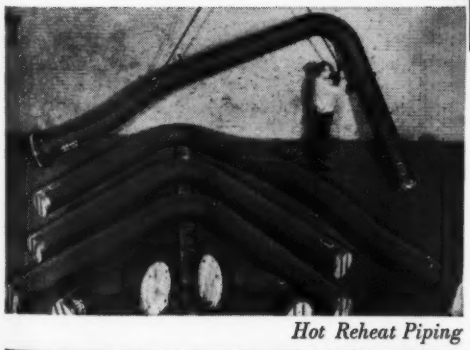
UNDER THE SECOND ROUND in its power demonstration reactor program AEC has received proposals for small power reactors from seven groups: Chugach Electric Association of Anchorage, Alaska and Nuclear Development Corp. of America (10,000 kw sodium cooled heavy water moderated); Gas & Electric Department of the City of Holyoke, Mass. (15,000 kw gas cooled with closed cycle turbine); City of Orlando, Fla. (25,000-40,000 kw liquid metal fueled); City of Piqua, Ohio (12,500 kw organic moderated); Rural Cooperative Power Association of Elk River, Minn. (22,000 kw boiling water); University of Florida at Gainesville (2000 kw pressurized light water); and Wolverine Electric Cooperative at Hershey, Mich. (10,000 kw aqueous homogeneous).

THREE GROUPS of U.S. insurance companies have plans under consideration to form syndicates to spread the risks incidental to the operation of atomic energy facilities and to increase the available coverage. Seventy capital stock casualty insurance companies of the Association of Casualty & Surety Companies have indicated provisional willingness to band together to provide third party bodily injury and property damage liability insurance against loss or damage caused by radiation. Capacity coverage may be up to $50 million. The National Board of Fire Underwriters, sponsor of a plan to provide physical property damage insurance, has tentative commitments from capital stock property insurance companies for coverage of "not less than $50 million." The third syndicate is a reinsurance pool of more than 91 mutual fire-casualty companies with a definite commitment to provide a minimum of $10 million in insurance protection to the operator of an industrial nuclear reactor. The pool will be managed by American Mutual Reinsurance Co. of Chicago. American Mutual expects that on very large risks all three pools will cooperate.

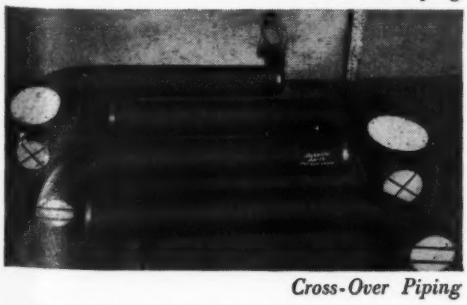
THE ARMY PACKAGE POWER Reactor being built by ALCO Products at Fort Belvoir, Va. is expected to produce power at about 15.6 mills per kwh, according to Kenneth Kasschau, manager of ALCO's atomic energy engineering. The firm also is forecasting that a larger plant of 10,000 kw (the APPR-1 is 2000 kw) would cost only $400 per kw as against $1000 per kw for the APPR-1.

Manual metallic-arc field welding. Electric coils, wound around areas adjacent to weld, are used in preheating, and in local stress relieving after completion of weld.

Main Steam Piping



Hot Reheat Piping



Cross-Over Piping

Shop fabricated assemblies above are produced to sizes which installation and shipping facilities permit.

FIELD ERECTION by P.P.&E.

Assures Safe, Efficient Operation of HIGH TEMPERATURE, HIGH PRESSURE PIPING

Pittsburgh Piping and Equipment Company was among the first to recognize the importance of complete piping fabricating service, including the responsibility for erection of the piping system.

At P.P.&E. sub-assembles are shop fabricated in sections as large as shipping facilities and installation area permits, are checked for dimensional alignment, and delivered ready for accurate erection. Field welds are planned for maximum accessibility. Consequently, erection by skilled, specially trained craftsmen is facilitated.

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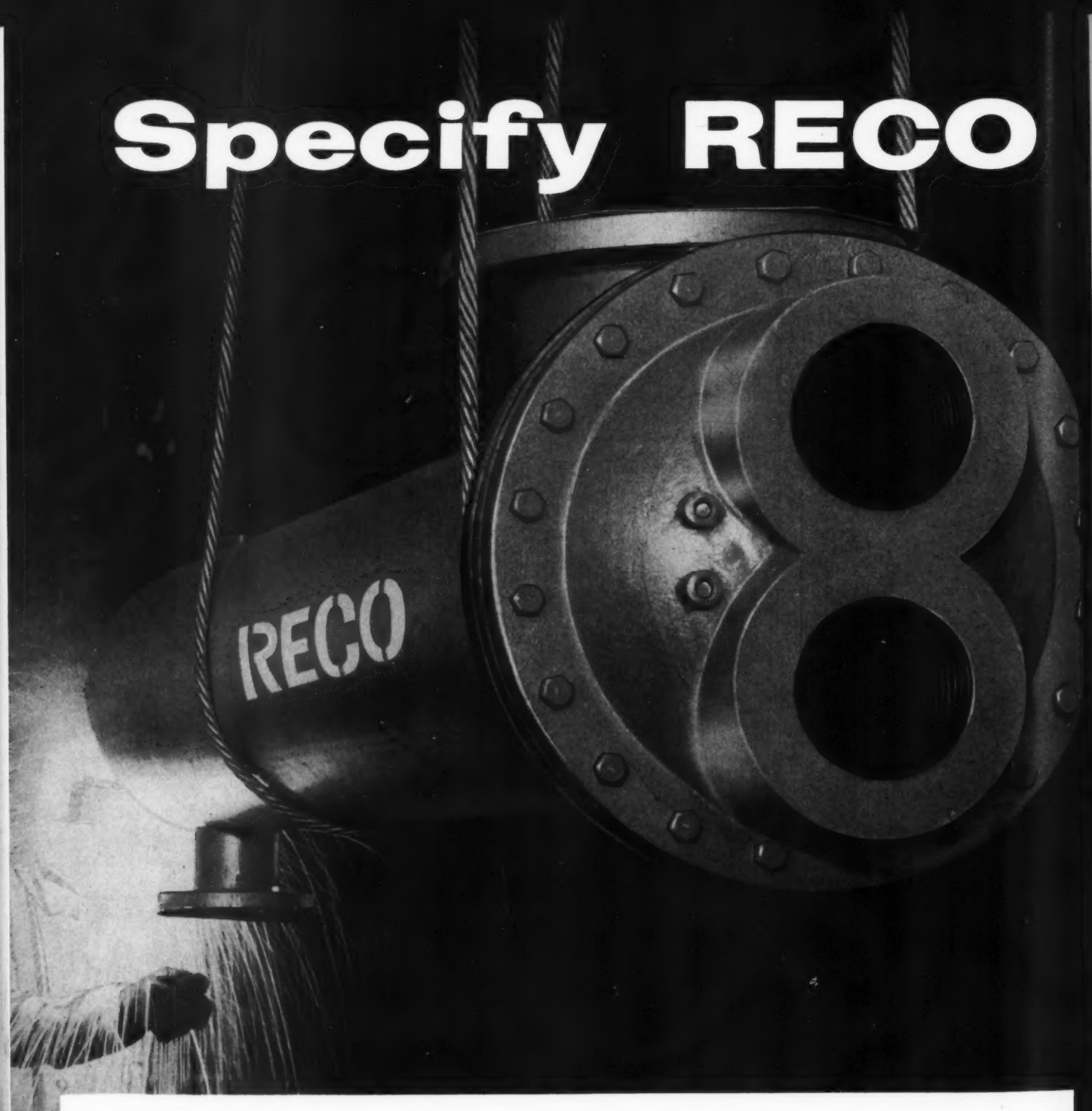

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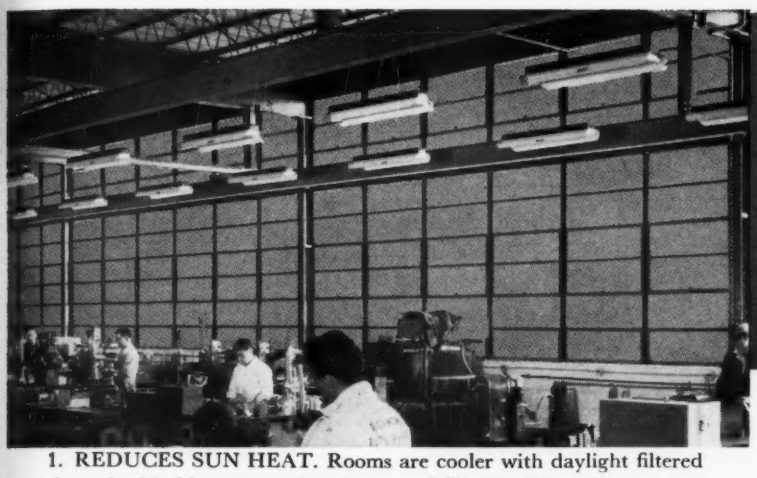

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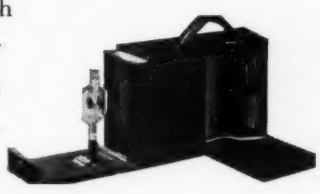

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Legislative Control of Pollution

AS WE HAVE seen in the past three columns in this series, there are available several methods of enforcing legal rights in the field of air and stream pollution. However, none of the means available at the common law has proved to be effective where pollution conditions have become widespread. In such situations—the result of increasing population concentration and industrial growth — there is a need for more specific laws and more effective enforcement of existing laws.

Primarily, air pollution legislation has taken the form of municipal ordinances. State-wide legislation is now in its early stages. A Federal air pollution law recently enacted provides funds for research but no regulatory measures.

Smoke Emission

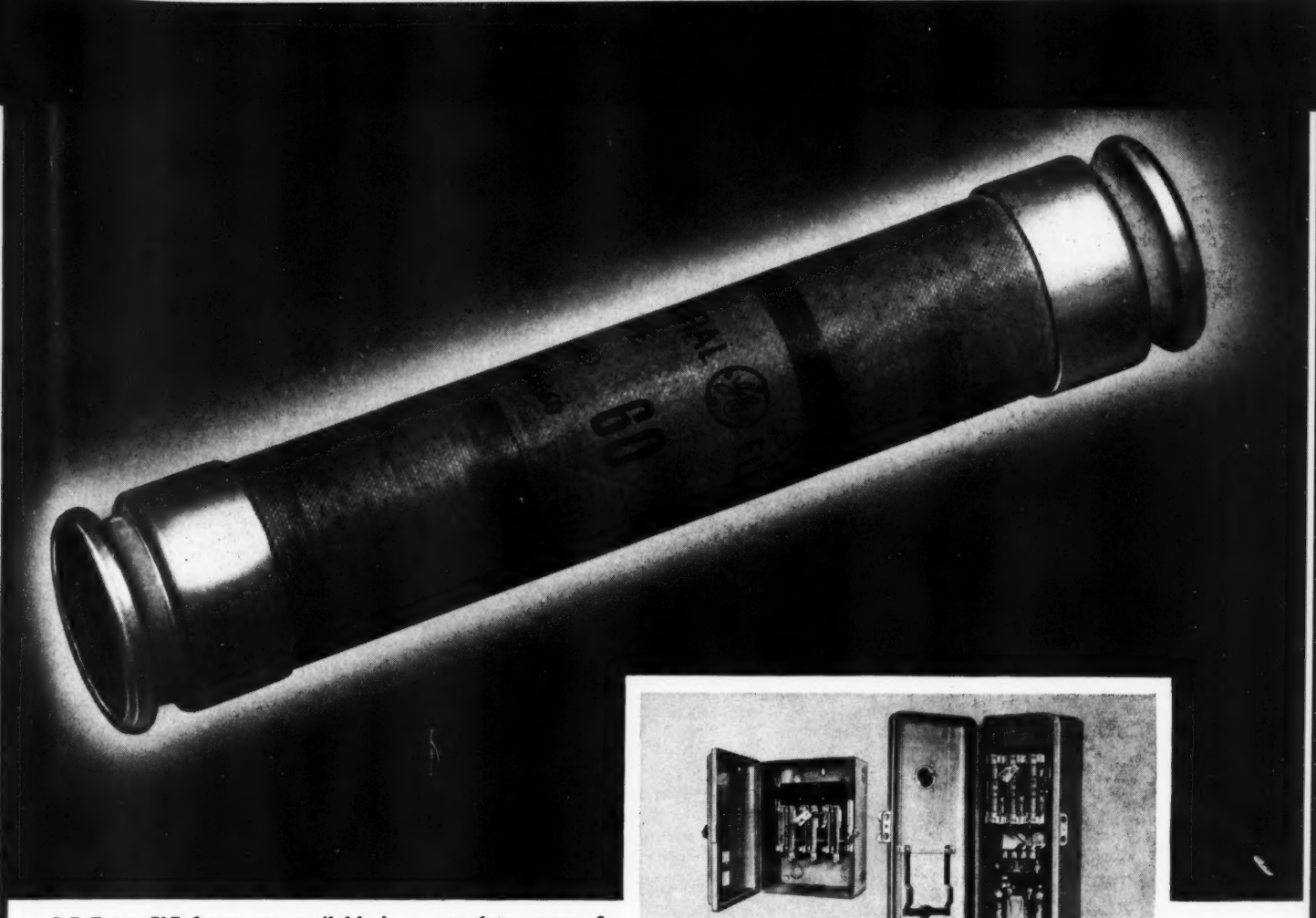
Most municipal ordinances are patterned after "model ordinances" such as that of the ASME or the National Institute of Municipal Officers. These emphasize smoke from combustion processes, while being relatively weak on other types of air pollution. They normally prohibit the emission of smoke of a certain density, usually defined by the Ringelmann Chart. (This chart consists of a series of numbered rectangles containing ruled squares. The higher numbers have thicker lines, so that a greater proportion of the rectangle is black. In use, the chart is set up at a specified distance so that it appears to be a homogenous shade of gray — increasing from white to black as the number increases.) While this is a simple device, and is acceptable by the courts, it is inconvenient in use and is sometimes replaced by an instrument called the Umbrascope, which uses gray glasses to measure opacity. Since it is known that the concentration of particles at ground level is independent of the particle density at the exit of the stack, but is proportional to the mass rate of emission, it follows that smoke density is not an accurate way to measure atmospheric pollution. For example, if one dilutes the stack gases one will reduce the smoke density reading without in any way diminishing air pollution. This is not recognized in many ordinances although a few attempt to prevent intentional dilution. Furthermore, the optical density is dependent not only on the particle density, but also on the thickness of the layer observed, i. e., on the diameter of the stack. Ordinarily, no direct provisions are made in the ordinances for regulating the mass rate of emission of smoke, or for taking into account the effect of the taller smoke stacks.

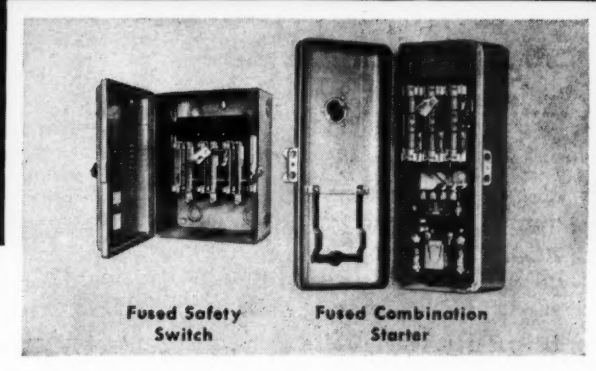
The method of measuring smoke emission is thus exceedingly crude. However, it is reasonably adequate when combined with regulations on the allowable percentage of volatile matter in the coal burned and provisions for permits and inspections on fuel-burning equipment. Of course it is useless at night or when the smoke is white, e. g., in cement plants.

Many ordinances also provide a permitted specified weight of particulate matter per unit volume of stack gases, based on fly ash from properly operated power plants. This is not a particularly satisfactory type of control, since the aggregate weight of particles is much less important than the number and total surface area of particles.

Other Types of Pollution

The emission of pollutants other than smoke, such as soot, cinders, noxious acids, fumes, and gases under such circumstances as to "endanger the health, comfort, and safety of any person or of the public" is usually declared by the ordinance to be a public nuisance. Since no specific limits are set for these pollutants, this section of the ordinance must be regarded merely as declaratory of the common law. Specifications on the allowable concentration of a few gases such as SO_2 have recently been provided in some ordinances (notably in Los Angeles), and





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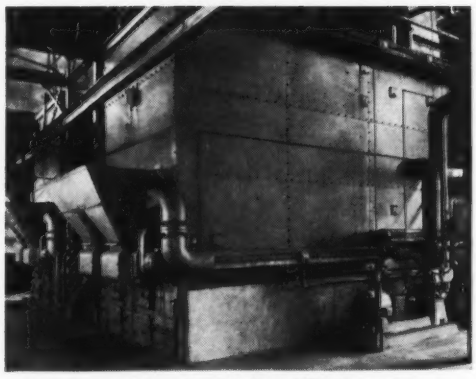

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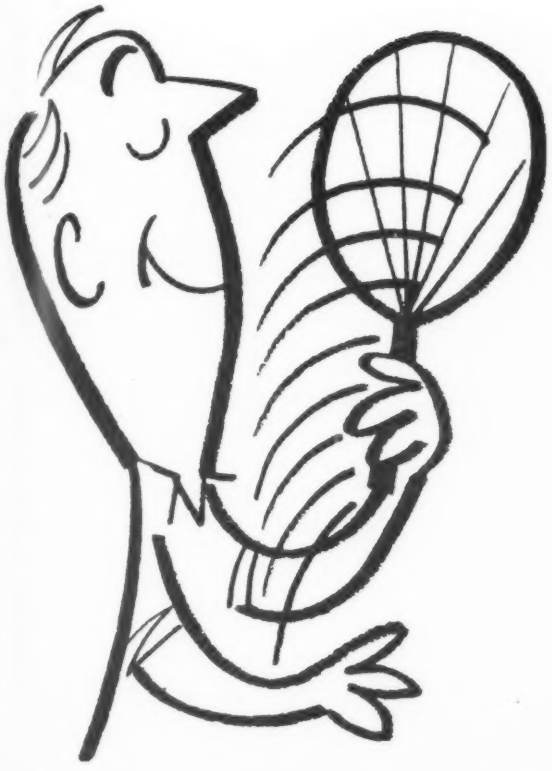
are expected to become widespread when more data become available as to effects of various gases at different concentrations.

Enforcement

A Superintendent of Smoke Prevention or Air Pollution Abatement is authorized by the usual ordinance to enforce the law, and is empowered to bring the necessary court actions to accomplish this purpose. A Board of Appeals is provided to hear appeals from decisions made by the Superintendent. Although legal action before the courts is, in the last analysis, necessary to enforce the actions of the Superintendent or the Board of Appeals, the court will accept the findings of fact if there is a showing that they are supported by any evidence. The court will limit its inquiry to question of law rather than of fact. Thus, in most cases, the decision of the Superintendent of the Board will be of crucial importance, the court merely acting to impose the proper penalty on the violator of the ordinance. Penalties prescribed in a typical ordinance are "not to exceed $200 for each violation," and imprisonment "not to exceed 30 days." The ordinances may also declare it to be a misdemeanor to interfere with the duties of the Superintendent. Thus he cannot be denied admission to the premises when it is necessary for him to make an inspection or observations. Some ordinances also empower the Superintendent to abate a pollution condition by sealing the equipment to prevent its use. Violation of the Superintendent's seal is punishable by fine or imprisonment.

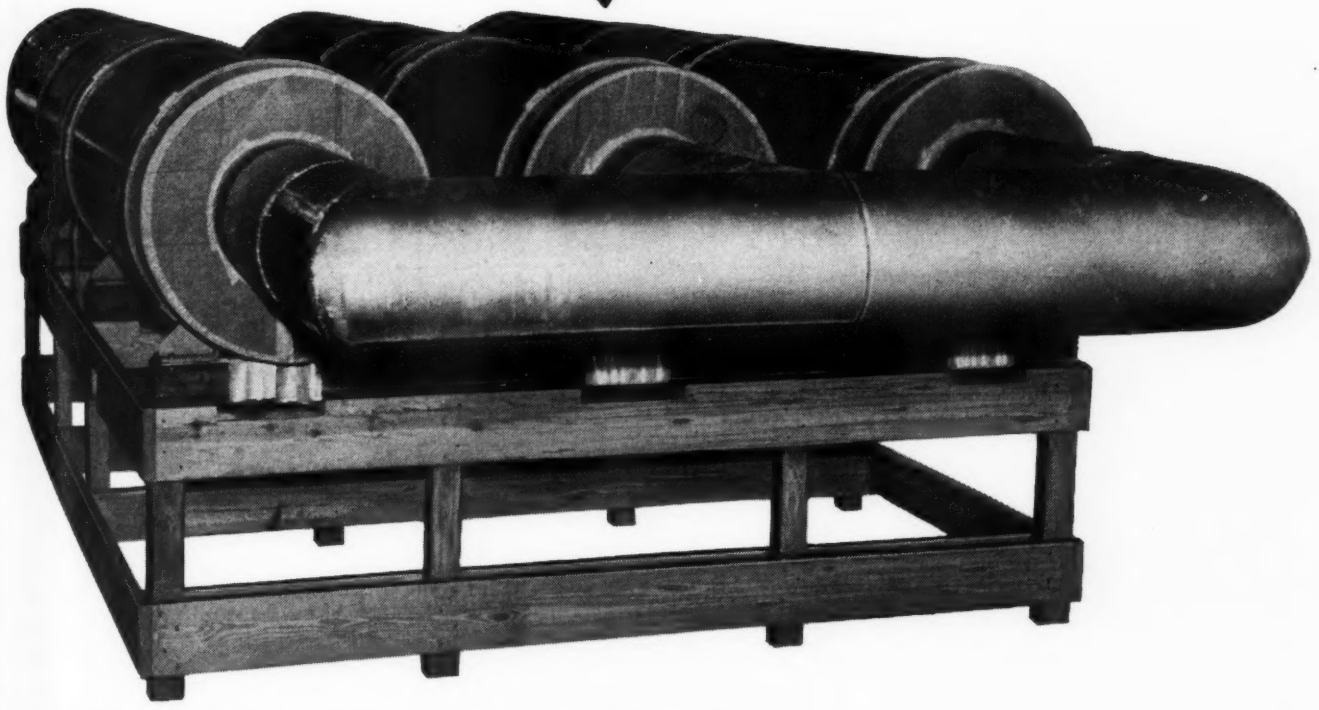
County and State Control

Although air pollution ordinances with teeth have been provided, and in some instances even enforced, it is difficult for any but the largest cities to provide effective enforcement even if they have reasonably good ordinances. As a result, county-wide and statewide legislation is now in the wind



First 10,000 amp **self-cooled** isolated phase bus ever built

I-T-E 10,000 amp self-cooled isolated phase bus in laboratory for thermal test.



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Bank building gets 15% more floor area

by using lightweight Milcor Celluflor

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consulting architects (exterior design)
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architect for original structure
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Naugle-Leck, Inc., Minneapolis, Minn.

Back in 1923 the Federal Reserve Bank Building in Minneapolis was built using heavy, wet mass construction. It consisted of three stories with a foundation capable of carrying seven additional floors of the same heavy construction. Now, thirty-three years later, lightweight Milcor Celluflor enabled the owners to add eight new floors instead of seven, obtaining 15% greater floor space without reinforcing the foundation.

The management of this building decided to use Celluflor to gain other advantages, too. Milcor Celluflor cells, spaced on 6-inch centers, permit the installation of power outlets anywhere, providing complete electrical flexibility. Additional cells are available to meet future needs such as automation, closed-circuit television, and other power installations.

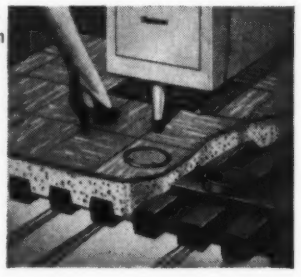
These are some of the reasons why Milcor Celluflor is specified for multi-floor buildings. Seven Celluflor types provide a broad area of opportunity for applying this modern, functional floor construction.

Catalog No. 270, available upon request, provides additional information and planning help.

MILCOR® Celluflor

Sketch of Celluflor installation in Federal Reserve Bank Building (T=Telephone; P=Power; F=Future)

Milcor Celluflor cells, spaced on 6-inch centers, permit the installation of service outlets at any point on the floor.



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in a number of places (e.g., in Michigan).

Stream pollution legislation has taken a different course from air pollution legislation, in that state action is more important than municipal ordinances. Virtually every state, as well as the Canadian provinces, now have effective stream pollution statutes. Most of them are administered by state health agencies.

The statutes generally do not require treatment of all wastes before discharge into streams. Instead, they specify the minimum amount of oxygen demand (B.O.D.) allowed. Other specifications in general use relate to pH, color, turbidity, taste, odor, and suspended or floating solids. Maximum allowable amounts of specific substances may be specified, including fluorides, chlorides, iron, and phenolic compounds.

Penalties

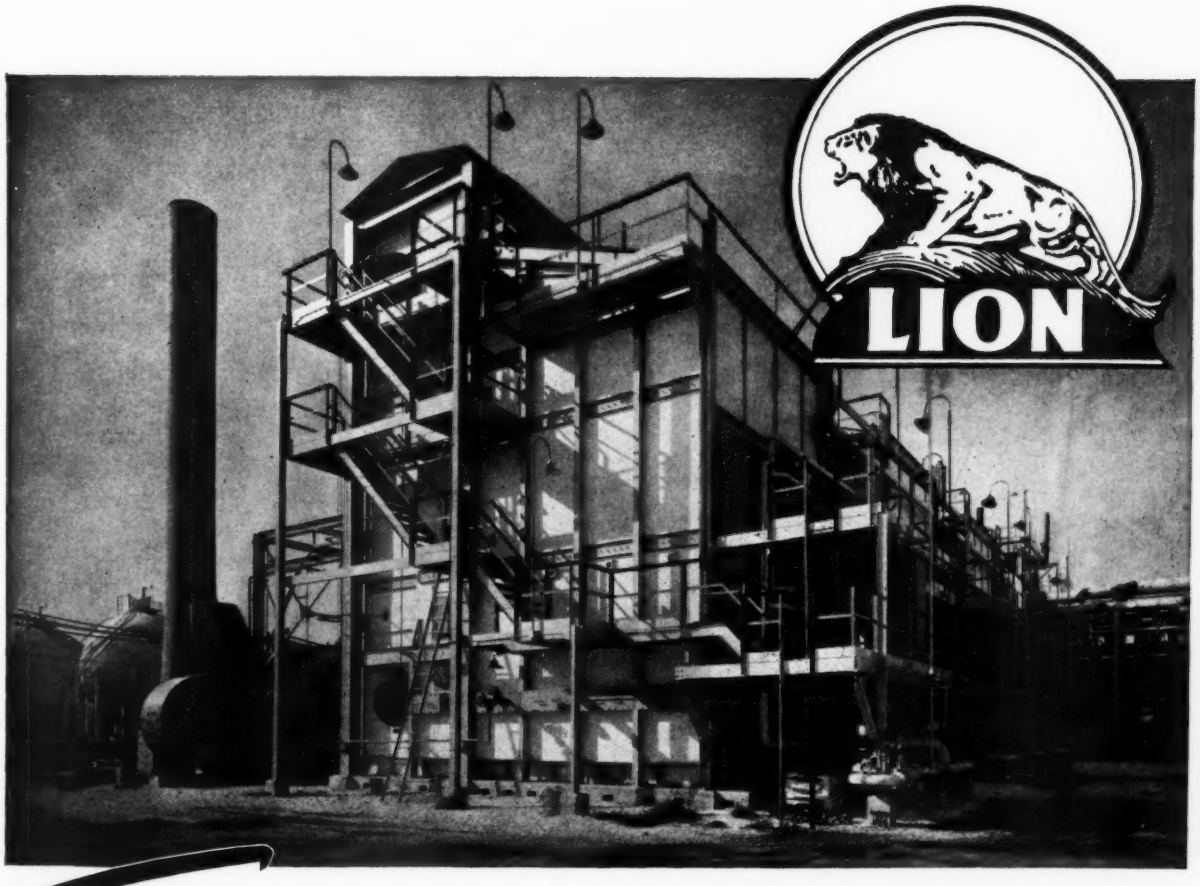
Most statutes require that plans for waste water treatment be presented to the board for approval. Penalties imposed by the statutes are generally fines and imprisonment. The board can also apply to a court for an injunction. In some parts of the country, interstate compacts have been made between several states for a single watershed.

A federal stream pollution statute was passed in 1948, and it is administered by the Public Health Service. It does not directly assess liability for pollution but instead provides monetary aid for state enforcement agencies and loans to industries and municipalities for the construction of pollution control plants.

Effect on the Common Law

It should not be supposed that legislative enactments supersede the common law of air and stream pollution. To some extent, the ordinances supersede the application of the common law of public nuisance, but they do not affect the law of private nuisance.

If the legislative body has de-



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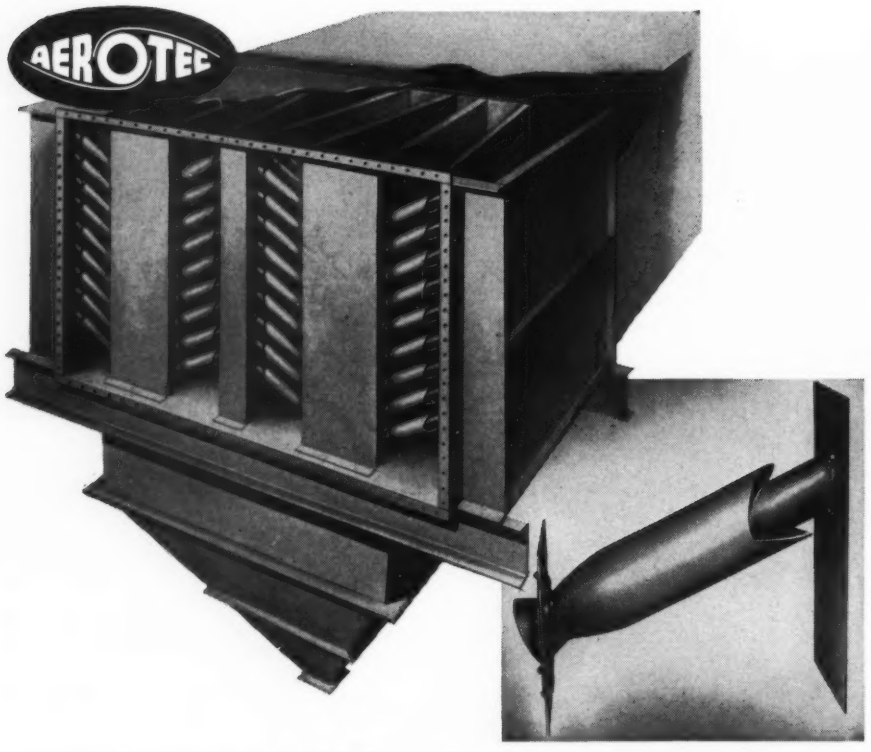

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Tubes are factory assembled into "building block" elements to simplify field erection. In addition, the inherent design of the 5" Tube reduces the possibility of plugging, even at low temperatures, or when the fuel has a high sulphur content. Years of research behind the development of this tube now assure a collector that requires minimum maintenance.

For information about the new Aerotec Tube, call or write to The Thermix Corporation, Project Engineers for Aerotec.

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clared a certain practice to be a public nuisance, this determination will be respected by the courts, provided the statute is not void because of arbitrariness. Despite the fact that the practice would not be a nuisance under the common law, it may still be abated in the manner prescribed by the legislation. Further, if a particular practice is permitted by the statute, it will in general not be held to be a public nuisance, despite the fact that under the common law it would have been a public nuisance.

Private Nuisance

According to some courts, practices that the legislature permits can no longer be private nuisances. The weight of authority is, however, definitely to the contrary. Thus, an action for private nuisance can still be brought despite the fact that the practice in question is permitted by the statute and is not deemed to be a public nuisance. The reason is that the public cannot take away private property or property rights without condemnation proceedings and purchase.

Public Nuisance

Nor should it be assumed that legislation completely replaces the common law of public nuisance. Statutory remedies for the abatement of nuisances do not, as a rule, supersede the existing common-law remedies. That is to say, an individual peculiarly affected by a practice that is a public nuisance under the statute may still bring an action for its abatement if the official designated by the statute refuses to do so. For example, if the official extends the period of grace beyond the time allowable in the ordinance or statute, it is possible that an action by an aggrieved private person can be brought. And an action of public nuisance generally is still needed if the source of the pollution is outside the territorial limits of the municipality, county, or state in which he resides. ▲▲

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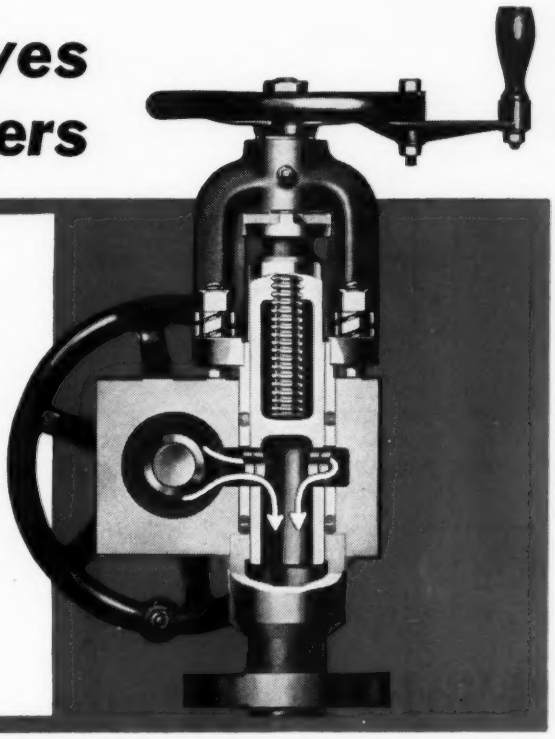
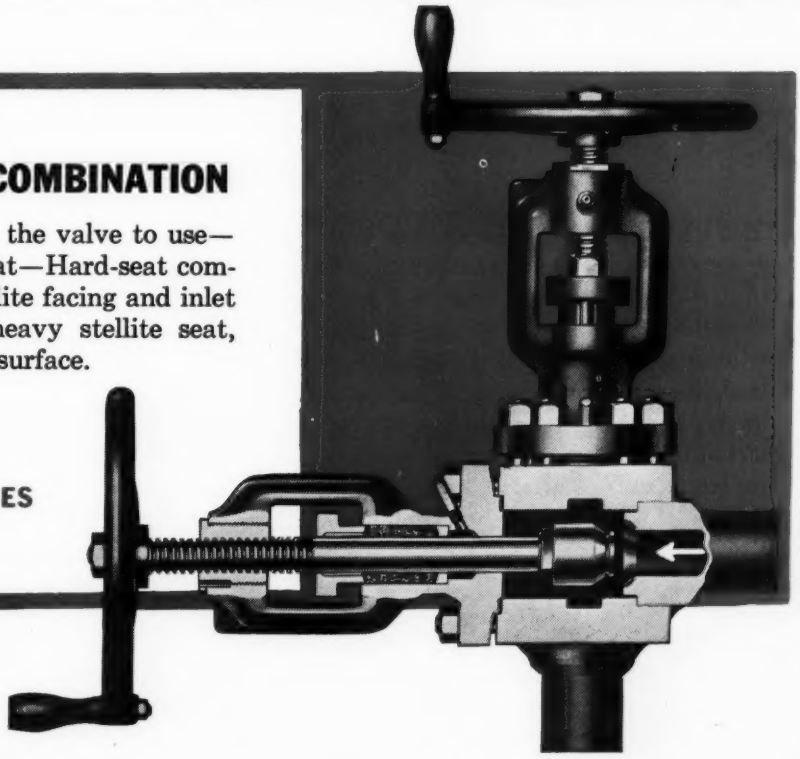
rugged blow-off valves for high pressure boilers



HARD-SEAT—SEATLESS COMBINATION

■ For boilers up to 1500 psi, this Yarway Unit Tandem Blow-Off Valve offers the maximum in dependable service. A one-piece forged steel block serves as the common body for the Yarway Stellite Hard-seat blowing valve and the Yarway Seatless sealing valve. All interconnecting flanges, bolts and gaskets are eliminated. The Unit Tandem at right is sectioned through Seatless Valve to show balanced sliding plunger in open position and free flow.



HARD-SEAT—HARD-SEAT COMBINATION

■ For boilers to 2500 psi, this is the valve to use—Yarway's Unit Tandem Hard-seat—Hard-seat combination. Disc has welded-in stellite facing and inlet nozzle has integral welded-in heavy stellite seat, providing smooth, hard-wearing surface.

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USE YARWAY BLOW-OFF VALVES

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YARWAY **BLOW-OFF VALVES**

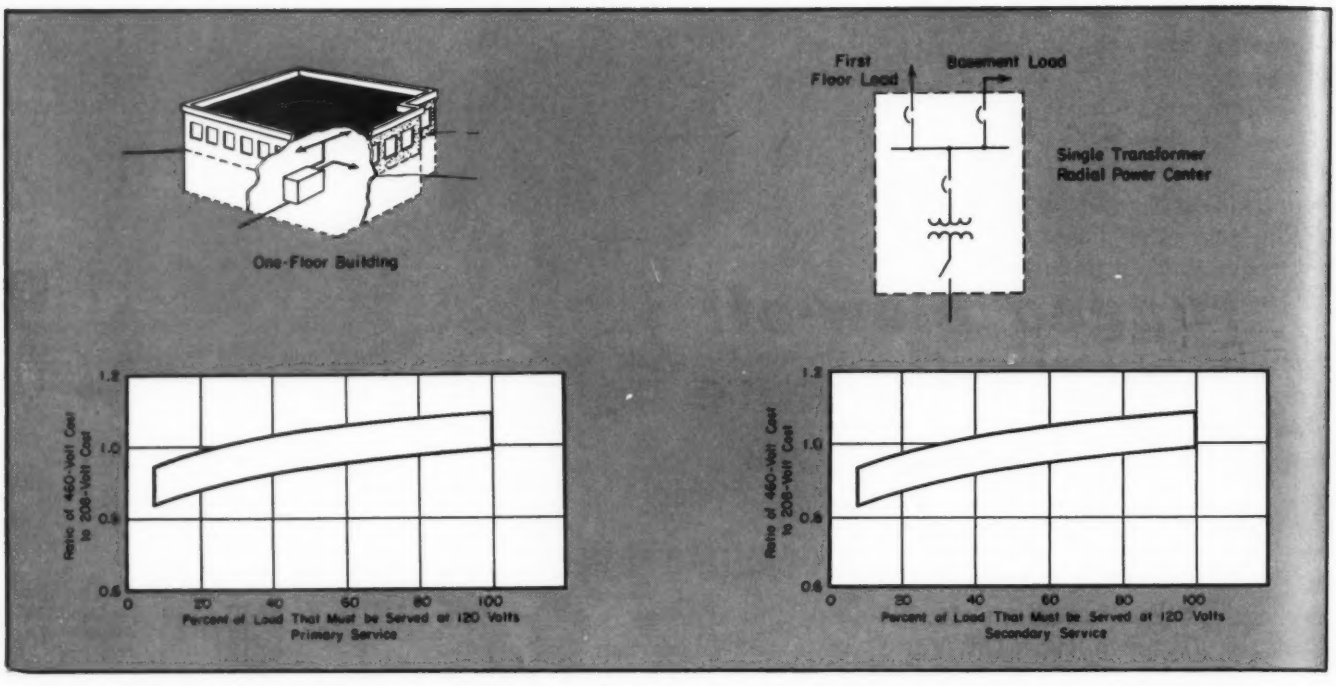


FIG. 1—RELATIVE COSTS OF 460-V SYSTEMS FOR ONE-STORY BUILDINGS ARE SHOWN IN CHARTS. LEFT CHART IS FOR PRIMARY SERVICE; RIGHT IS FOR SECONDARY. WIRING DIAGRAM FOR BUILDING IS SHOWN ABOVE.

The Advantages of Higher Voltage for Commercial Buildings

R. A. ZIMMERMAN and H. E. LOKAY
Westinghouse Electric Corporation

THE PERCENT OF LOAD that must be served at 120 volts determines the savings that can be effected by higher-voltage distribution in commercial and institutional buildings. If a higher voltage system is used, these 120-volt loads must be served through dry-type, step-down transformers, and this offsets part of the savings in the total electrical costs resulting from the use of a higher voltage system. If the percent of 120-volt load is high, the cost of these transformers may be so great that cost calculations will favor a 120/208-volt system.

Inasmuch as it is economically advantageous to minimize the amount of 120-volt load, a survey of the loads should be made to determine which must be served at 120 volts and which can be served at a higher voltage. The outlet loads and incandescent lighting usually are available only for 120-volt operation. The fixed motor loads and the electric discharge lamps are available for operation at a higher voltage. A higher voltage distribution system usually will be economical in office buildings, shopping center, schools, and hospitals, for in all of these fluorescent lighting can be used predominantly, thereby greatly reducing the percent of load that must be served at 120 volts.

Industrial plant experience with higher voltage distribution systems has led to the acceptance of 265/460 volts as the nominal system voltage for building distribution. The 265/460-volt system is a grounded wye, three-phase, four-wire system. The fluorescent lighting is served at the line-to-neutral voltage of 265 volts and the fixed motor load at the line-to-line voltage of 460 volts.*

Economic Analysis

The authors have made extensive studies of the relative economics of 120/208 and 265/460 volts in

*Both 265/460 volts and 480Y/277 volts have been used to describe the same higher voltage system. The 265/460 volts is the nominal system voltage and the 480Y/277 volts is the low-voltage rating of the supply transformers.

several different size buildings and for a large number of variations of load for each of these buildings. The load variations were made not only with respect to magnitude, but with respect to the percent of the total load that required service at 120 volts. The economic importance of the 120-volt load is illustrated graphically in the charts in Figures 1 through 4. The bandwidths shown in the charts are based upon a plus or minus 5 percent variation on the mean of all cases studied. All of the cases fell within these bands. Brief investigations of several new buildings have shown savings that confirm these bandwidths.

Cutaway views of the various size buildings and the single-line diagrams of the systems that were studied by the authors also are shown. The panelboard arrangements on each floor for both system voltages are shown in Figures 5 and 6.

Table I lists the various system components considered in the economic comparison and gives the percent of the total cost represented by each component in several typical cases. Subtotals in terms of percent of total cost are given for the service entrance, distribution system, and the utilization equipment. The proportion of the total cost represented by the service entrance is higher when primary service is provided than when secondary service is provided because the cost of the transformer units is included in the cost of primary service. The service entrance represents from 2.6 to 21 percent of total costs depending on whether primary or secondary service is provided.

The distribution system represents only from 13 to 31 percent of total electrical costs, while the utilization equipment represents from 54 to 79 percent. This emphasizes the importance of including the utilization equipment in any economic analysis.

Higher Voltage Favored

The principal advantage of the higher voltage system results from less current and less voltage drop in the circuits for a given load. Fewer or smaller circuits can be used to carry power from the service-entrance point to panelboards or other final distribution points. Smaller conductors can be used in many

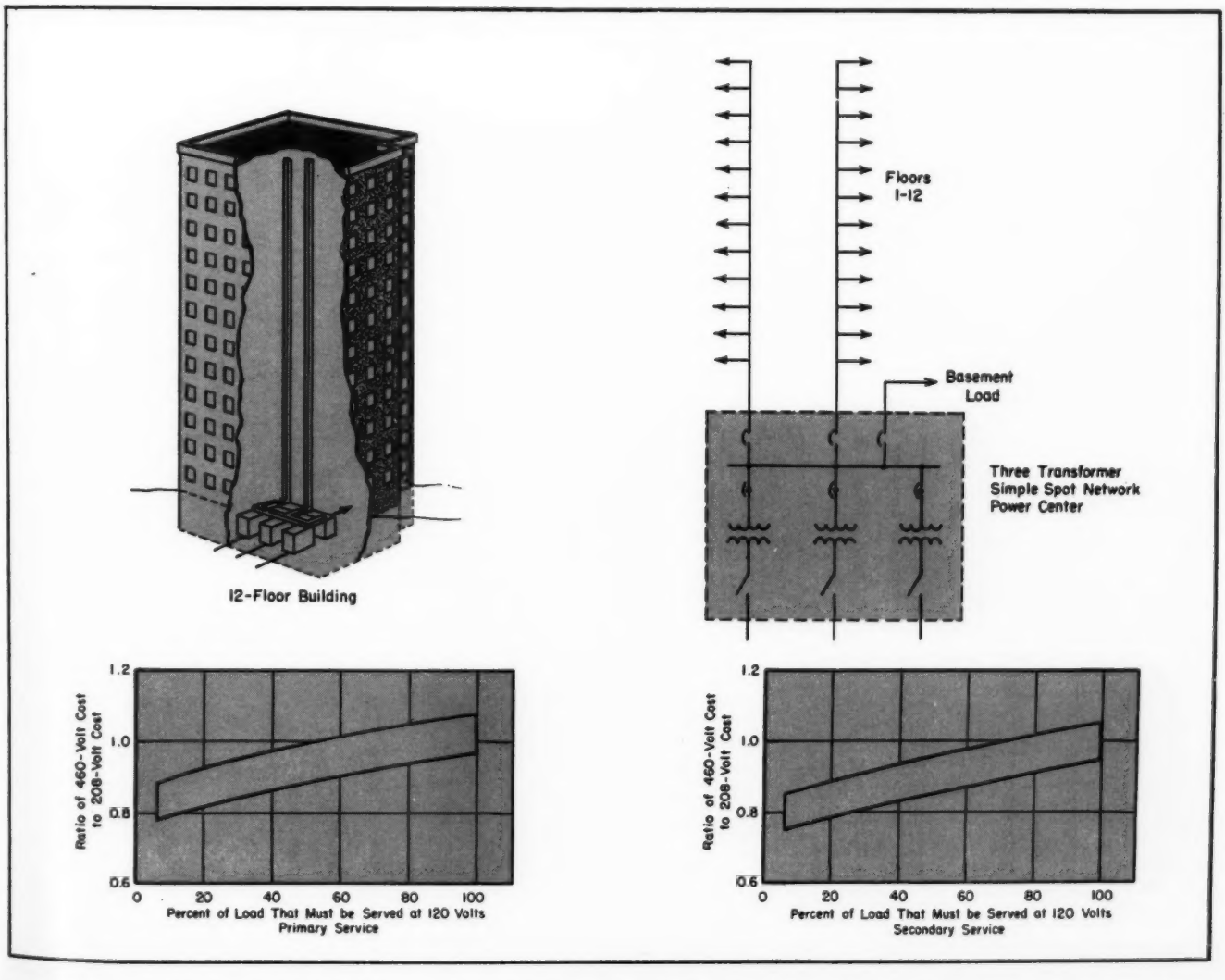


FIG. 2—PRIMARY (LEFT) AND SECONDARY (RIGHT) SYSTEM COSTS FOR 460-V SYSTEM COMPARED TO COSTS OF 208-V SYSTEM ARE SHOWN IN TWO CHARTS. CUTAWAY OF BUILDING AND LINE WIRING DIAGRAM ARE ABOVE.

TABLE 1—RELATIVE COSTS OF ELECTRICAL COMPONENTS IN COMMERCIAL BUILDINGS

	One Floor						Twelve Floors						Thirty-Six Floors									
	Primary Service			Secondary Service			Primary Service			Secondary Service			Primary Service					Secondary Service				
	System Voltage						System Voltage						System Voltage									
	208	460	460	208	460	460	208	460	460	208	460	460	208*	460	460	460*	460*	208*	460	460	460*	460*
	Percent Load at 120 Volts						Percent Load at 120 Volts						Percent Load at 120 Volts									
	100	12.2	39.2	100	12.2	39.2	100	11.7	40.5	100	11.7	40.5	100	12.6	44.7	12.6	44.7	100	12.6	44.7	12.6	44.7
Primary Service	7.3	7.7	7.5	—	—	—	6.7	7.8	7.4	—	—	—	4.1	3.3	3.1	3.3	3.1	—	—	—	—	—
Secondary Service	—	—	—	5.5	4.1	3.9	—	—	—	7.5	4.5	4.0	—	—	—	—	—	4.4	4.2	4.0	2.8	2.6
Transformer Units	13.3	13.5	13.1	—	—	—	12.3	12.6	11.9	—	—	—	10.8	9.0	8.5	10.6	9.8	—	—	—	—	—
Service Entrance Total	**20.6**	**21.2**	**20.6**	**5.5**	**4.1**	**3.9**	**19.0**	**20.4**	**19.3**	**7.5**	**4.5**	**4.0**	**14.9**	**12.3**	**11.6**	**13.9**	**12.9**	**4.4**	**4.2**	**4.0**	**2.8**	**2.6**
Switchboard	5.4	4.4	4.3	6.5	5.4	5.2	8.7	3.7	3.5	9.9	4.5	4.3	6.7	2.9	2.8	3.1	3.8	7.5	3.2	3.0	3.5	3.3
Bus Duct Risers	—	—	—	—	—	—	6.7	4.3	4.1	7.6	5.1	4.8	8.7	9.8	9.2	5.5	5.2	9.8	10.6	10.0	6.2	5.8
Panelboards	1.0	1.1	1.1	1.2	1.3	1.3	2.0	2.6	2.2	2.4	3.1	2.6	2.1	2.4	2.3	2.5	2.3	2.4	2.6	2.5	2.8	2.6
460 to 120 Volt Transformers	—	0.8	3.1	—	1.0	3.8	—	1.5	4.5	—	1.8	5.4	—	1.6	4.6	1.6	4.7	—	1.7	5.0	1.8	5.3
Feeder Circuits	1.9	1.9	1.0	2.3	2.3	1.2	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Branch Circuits	5.4	4.7	5.6	6.4	5.7	6.7	7.7	6.3	8.4	8.9	7.6	10.0	7.9	6.5	8.5	6.7	8.6	8.9	7.4	9.3	7.6	9.9
Miscellaneous Motor Circuits	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.5	0.3	0.4	0.4	0.4
Air Conditioning Motor Circuits	0.7	0.4	0.3	0.9	0.4	0.4	1.2	0.9	0.9	1.3	1.1	1.0	1.1	0.9	0.8	0.9	0.8	1.2	1.0	0.9	1.0	1.0
Elevator Motor Circuits	—	--	—	—	—	—	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.2	0.2
Distribution System Total	**14.6**	**13.5**	**15.6**	**17.5**	**16.4**	**18.8**	**26.9**	**19.8**	**24.1**	**30.8**	**23.7**	**28.6**	**27.5**	**24.7**	**28.8**	**21.0**	**26.0**	**30.9**	**27.1**	**31.4**	**23.6**	**28.6**
Miscellaneous Motors	2.0	2.0	2.0	2.4	2.5	2.4	4.8	4.6	4.3	5.4	5.5	5.1	4.5	4.5	4.3	4.7	4.4	5.0	5.0	4.7	5.3	4.9
Air Conditioning Motors	33.3	32.3	31.6	39.5	39.2	38.2	10.9	10.9	10.3	12.4	13.1	12.3	10.2	10.1	9.6	10.5	9.8	11.5	11.0	10.3	11.8	11.1
Elevator Motors	—	—	—	—	—	—	1.1	1.3	1.2	1.3	1.6	1.5	4.4	4.5	4.2	4.6	4.3	4.9	4.9	4.6	5.2	4.9
Luminaires	29.5	31.0	30.2	35.1	37.8	36.7	37.3	43.0	40.8	42.6	51.6	48.5	38.5	43.9	41.5	45.3	42.6	43.3	47.8	45.0	51.3	47.9
Utilization Equipment Total	**64.8**	**65.3**	**63.8**	**77.0**	**79.5**	**77.3**	**54.1**	**59.8**	**56.6**	**61.7**	**71.8**	**67.4**	**57.6**	**63.0**	**59.6**	**65.1**	**61.1**	**64.7**	**68.7**	**64.6**	**73.6**	**68.8**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

*Power Centers located in basement and on 24th floor

of the branch circuits serving power loads, and some reduction in branch circuits supplying fluorescent lighting may be possible.

It is easier to keep the voltage drop to the loads within customarily accepted limits in 460-volt circuits. However, this may not be true for the loads that must be served at 120 volts from a 460-volt system. This is due to the additional voltage drop introduced by the dry-type transformer required to step down the current to 120 volts.

Power center transformer cost is basically proportional to kva and is affected little by choice of 460 or 208 volts. In the 208-volt system the size of transformer units may be limited by the practical size of protective devices; in the 460-volt system, the available protective devices may permit the use of larger transformer ratings with a correspondingly lower cost per kilovolt-ampere.

The choice of voltage may influence the total cost of transformers in buildings of 15 to 35 floors. When using a 208-volt system in buildings of this size, it may be impractical to supply all the building load

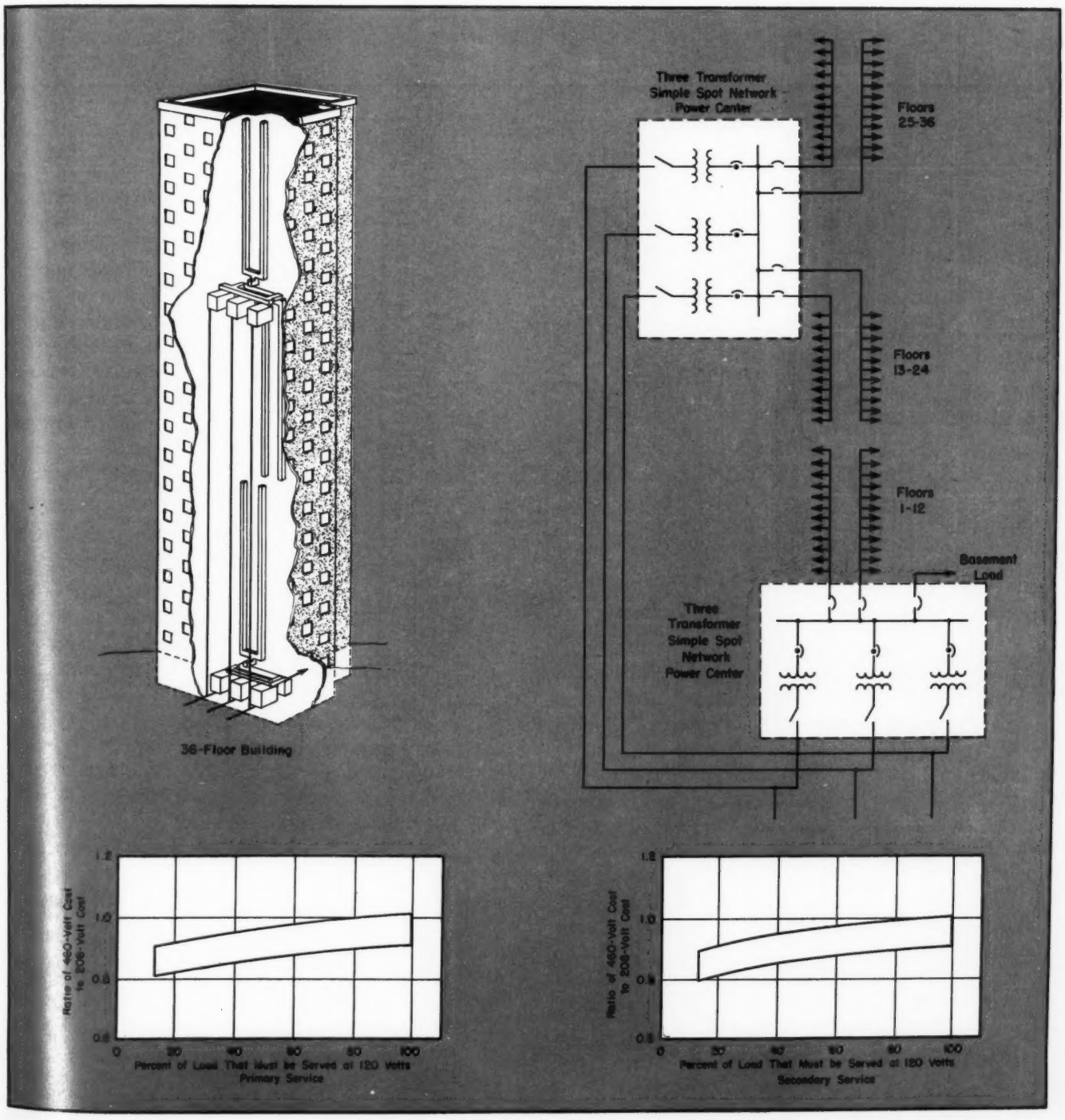


FIG. 3.—CHARTS SHOW RELATIVE COSTS OF PRIMARY SYSTEM (LEFT) AND SECONDARY SYSTEM (RIGHT) FOR A 36-FLOOR BUILDING WITH POWER CENTERS FOR BOTH THE SYSTEMS LOCATED AT TWO LEVELS IN THE BUILDING.

from power center transformers located at basement level. This means that some power center transformer capacity must be located up in the building in what could be rentable office space. Use of the 460-volt system in these taller buildings makes it practical to locate all power center transformers at basement level. The relative economics of locating transformer capacity up in the building is shown in comparing Figures 3 and 4.

The cost of protective devices in the switchboards and power centers is roughly proportional to the aggregate ampere demand of the loads and, therefore, favors the use of the higher voltage.

The cost of the feeder or riser circuits is approximately proportional to the ampere or thermal capacity. Since the current for a given load is less at 460 volts, the required total current carrying capacity, and consequently the total feeder circuit cost, is significantly less.

The total cost of the panelboards will be about the same for both voltages even though there will be fewer branch circuits in the higher voltage system. This is because the individual circuit protective devices cost more at 460 volts and because some 120-volt panelboards must be used in conjunction with the 460-volt panelboards to supply the 120-volt loads.

Although the number of branch circuits can be reduced at the higher voltage, the total cost of these

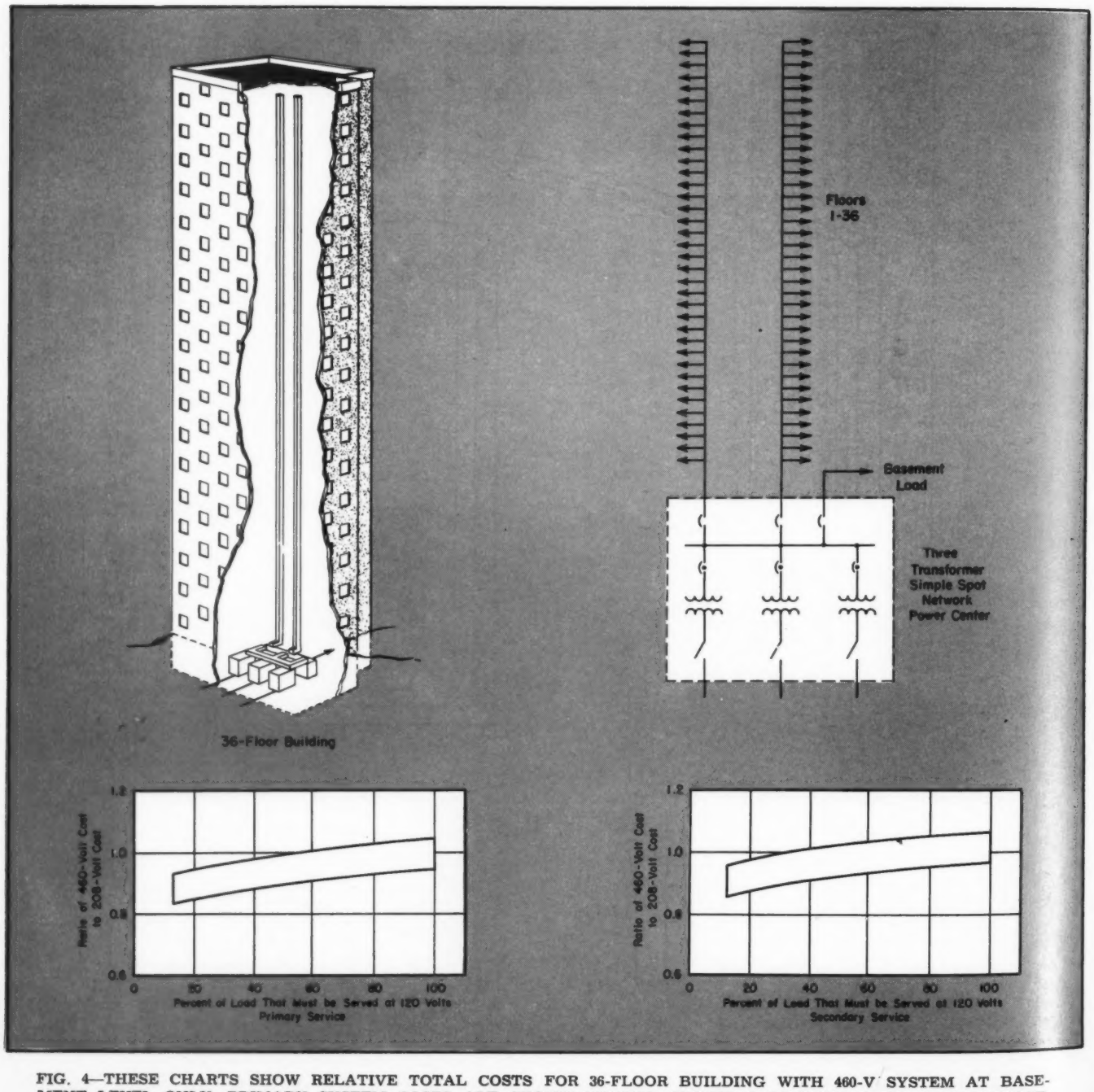


FIG. 4—THESE CHARTS SHOW RELATIVE TOTAL COSTS FOR 36-FLOOR BUILDING WITH 460-V SYSTEM AT BASEMENT LEVEL ONLY. PRIMARY SYSTEM COSTS ARE SHOWN AT LEFT, SECONDARY SYSTEM COSTS ARE AT RIGHT.

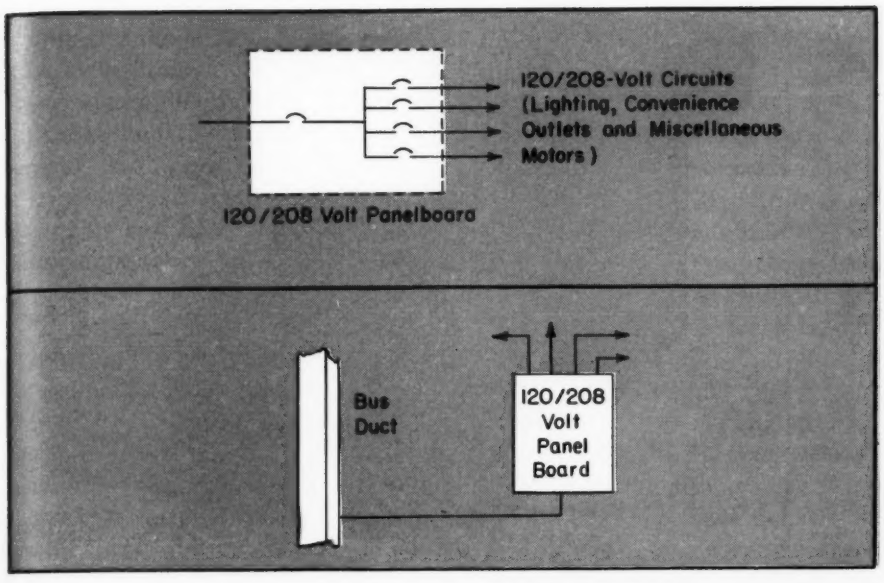
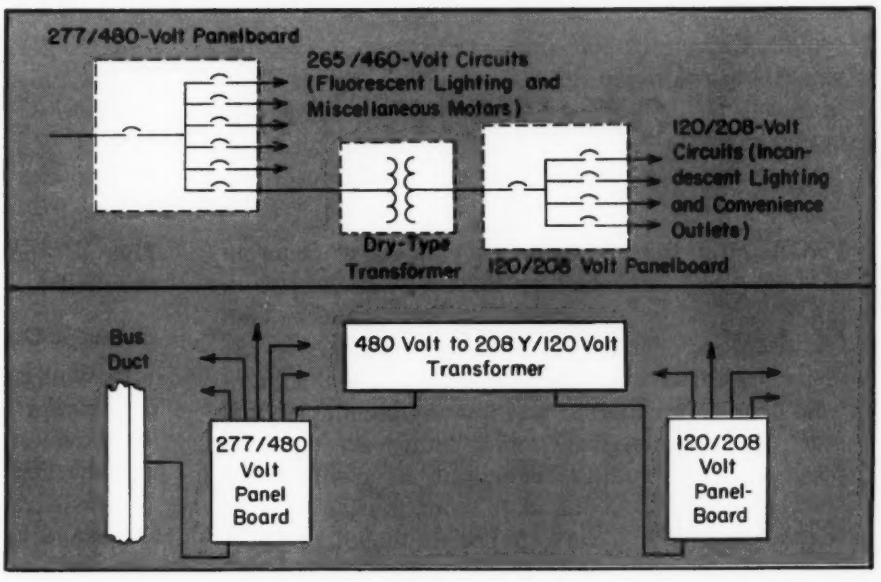


FIG. 5—PANELBOARD ARRANGEMENT AND SINGLE-LINE WIRING DIAGRAM FOR EACH FLOOR WITH A 120/208 VOLT DISTRIBUTION SYSTEM.

FIG. 6—PANELBOARD ARRANGEMENT AND SINGLE-LINE WIRING DIAGRAM FOR EACH FLOOR WITH A 265/460 VOLT DISTRIBUTION SYSTEM.



circuits is not reduced proportionally. This is because the smaller, practical size conductors (#10 or #12 copper) can be used for either voltage and because these circuits must be run to all fixtures distributed over the area. This means that although there may be fewer circuits, the size and total length of branch circuits will not differ too much. The convenience outlet wiring is essentially the same regardless of the system voltage inasmuch as the outlets must be served at 120 volts.

Utilization Devices

The utilization devices represent more than half of the total electrical investment in most commercial buildings. For this reason, any economic analysis should include the utilization devices.

Large motors (such as compressor or pump drives) and their controls cost less per kva at 440 volts than at 220 or 208 volts. However, smaller three-phase and fractional hp motors and their associated controls cost the same (or less) per kva at the 200-volt level as at 440 volts.

Fluorescent lighting can be used at either 208 or 265 volts, and the luminaire cost is about the same.

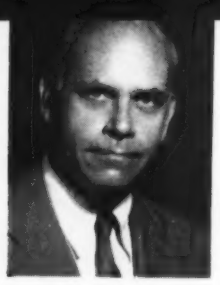
Code Permits Higher Voltage

The 1953 revision of the National Electric Code permits the use of voltages up to 300 volts to ground on circuits supplying permanently installed electric-discharge-lamp fixtures, provided luminaires are mounted not less than eight feet above the floor and do not have a manual switch as an integral part of the fixture. The revision has opened the way to the use of the higher voltage to supply all loads in a building with the exception of outlet loads and incandescent lighting. Local codes and standards probably will present no lasting restrictions on the use of 460 volts for commercial building wiring.

Properly installed systems can be as free of hazard to people and property at 265/460 volts as at the more commonly used 120/208 volts. A few special precautions are required for proper installation of the 460-volt circuits, but these precautions will have only a minor or insignificant effect on costs. Although, in some areas, electricians with higher classifications may be required to maintain a 460-volt system, there is no basic difference in the maintenance and wiring techniques for the 460- and the 208-volt systems.

Reference

"Relative Feasibility of 460-volt or 208-volt Service in Commercial Buildings," by H. G. Barnett, R. A. Zimmerman, and H. E. Lokay; *AIEE Transactions*, Vol. 73, pp. 306-313.



H. S. WOODWARD

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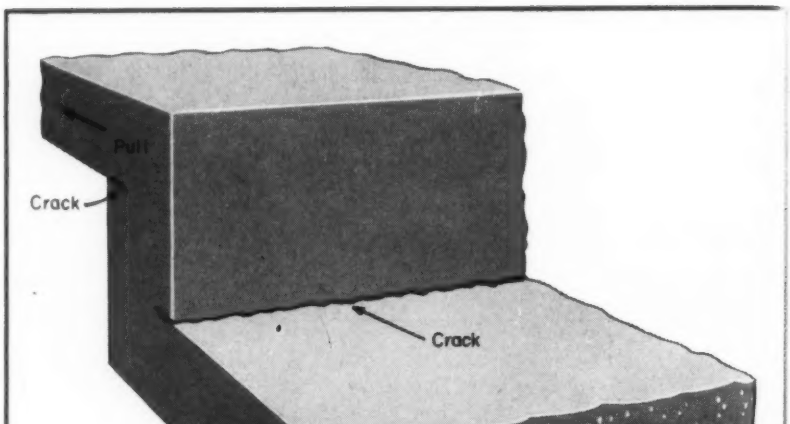


FIG. 1.

Practical Aspects of

Concrete Volume Shrinkage

PROBABLY the most annoying aspect of concrete construction is that of shrinkage — a change of volume due to set. Cracks are an eyesore; first to the owner, who usually interprets them as a sign of weakness, poor concrete, and imminent collapse; and second, to the engineer, who interprets them as poor concrete quality, oversight in design considerations, or just another contribution to his frustrations. It is a rare, if not mythical, concrete that has no shrinkage cracks. Generally speaking if you have concrete in any large volume, you are sure to have some cracks. To keep them to a minimum in size and extent is the goal. It is not generally understood, even by engineers, that all the ingredients of the concrete mix have an effect on shrinkage, not only the water and cement content but the aggregates and even the chemical composition of the cement. To get a picture of the practical aspects, we should know the relative importance of the various materials and methods.

Shrinkage is caused by all of the following factors, but their order does not necessarily indicate their relative importance.

¶ Chemical composition of cement
¶ Mineral characteristics of the aggregates
¶ Grading of aggregates
¶ Water content or water-cement ratio
¶ Mixing
¶ Proper placing
¶ Quality of curing
¶ Size of pour

This list encompasses practically all factors that should be considered for any high grade concrete.

Chemical Composition of Cement

Cement is one ingredient whose quality we accept if it conforms to certain specifications. Yet drying shrinkage of portland cement concretes are affected to a marked extent by the chemical composition of the cement. Tests have shown that the drying shrinkage of one cement may be as much as 50 percent greater than that of another. It can be said, in general, that shrinkage of concrete is low for the cements that are high in tricalcium silicate and low for cements low in the alkalies, soda, and potassa. Until cement specifications limit or define these ingredients, with shrinkage characteristics in mind, this is of academic interest only. Other cement ingredients also affect shrinkage somewhat.

The most practical method of selecting a cement for shrinkage characteristics is on the basis of mortar specimens made with approximately the same water-cement ratio as that to be used on the job. Laboratory tests of these can be made to permit selection of the lowest shrinkage cement.

Aggregates

The mineral character of the concrete aggregates also has an influence on drying shrinkage. Aggregates that are hard, dense, and have low absorption and a high modulus of elasticity have substantially less shrinkage. For instance, a concrete with crushed sandstone of fairly high absorption, or a gravel with

a heterogeneous mixture of rock types, may have a drying shrinkage 50 percent greater than a concrete with an aggregate of a dense, hard, low-absorption limestone or dolomite.

Consequently, we can safely say that with both cement and aggregates of low shrinkage qualities, it is possible to obtain a concrete with a shrinkage less than one half that of a concrete mixed with materials having high shrinkage characteristics.

Grading

Grading of aggregates also affects shrinkage. A well graded aggregate is always desirable, not only from a strength viewpoint, but also for shrinkage qualities. Good grading gives that desirable quality of a smaller percentage of voids. Also the larger the aggregate, the smaller the shrinkage. For example, considering mixes with equal water-cement ratios, the shrinkage of a sand mortar may be two or three times greater than that of a concrete with a ¾-inch minimum aggregate, and three or four times that of a concrete with a 1½-inch maximum.

Of course, workability of the mix is an important practical consideration. The best way to determine suitable proportions is to study trial mixes, where aggregate sizes and proportions are varied to get the desired workability for the particular job.

Water Content

The main cause of shrinkage in a concrete mix is the loss of water. This loss can be caused by evaporation, absorption by the aggregate particles, absorption by the forms, and hydration.

Evaporation loss is reduced by proper curing. Absorption by the forms is reduced by the usual oil treatment of the wood. The importance of low absorption aggregate has already been pointed out.

So much has been written in recent years regarding the water-cement ratio that nearly everyone familiar with construction knows the fundamentals. The same principles pertaining to the production of a strong, dense concrete also contribute to one with low shrinkage characteristics. Usually, water content should be kept to the minimum requirements for the particular job, and then every effort should be made to preserve as much of the water as possible for hydration over a considerable period of time.

Cement Paste

The cement paste is the principal material responsible for volume changes. A high cement content increases the volume of the paste and also the volume of mixing water. Hence, even though the high cement content substantially decreases the water-cement ratio and increases the strength of the concrete, it will lead to increased shrinkage. In the interest of minimum shrinkage, it is advantageous to specify a mix with as small a cement content as possible — while still meeting strength requirements for that particular project.

Mixing

Mixing is of great importance in getting a uniform concrete. The longer the mixing period, the higher the strength. Thorough mixing also gives increased workability, which will allow slightly larger quantities of aggregate for a given quantity of cement and water. To obtain a concrete with a low shrinkage factor, a longer mixing period is advisable.

Placing

Placing is an important operation but one that receives less attention than other concrete operations. A good many contractors pay almost no attention to this detail. Care must be exercised to prevent segregation, which results from depositing concrete at one point and letting it flow to distant points, a common fault in walls. Tamping or puddling excessively will cause materials to separate. Light spading next to the forms to prevent honeycombing is usually essential. The excess water that accumulates on the top should be worked to a low point and removed. Laitance should not be permitted.

Curing

This is probably the second most important operation in getting a low shrinkage concrete. If all precautions up to this point are rigidly adhered to, but curing is neglected, all will be in vain, for some cracks will probably occur unless moist weather comes to the rescue. No contractor wants to spend any money on curing unless he feels that he is going to be penalized for poor results.

Under favorable conditions the chemical reaction that takes place between water and cement, called hydration, occurs rapidly at first and then more slowly for a long period of time.

The usual specifications require the concrete to be moist for at least 7 days. The customary methods are: intermittent spraying; covering with a membrane; spraying with chemicals; sand blanketing; covering with wetted burlap blankets.

Intermittent spraying is not satisfactory in hot, dry weather. Some tests have shown that minimum moisture loss occurs when waterproof paper is used, and certainly some membrance should be used for adequate curing. Protection against damage during construction operations should be given the membrane. Vertical surfaces also should be protected either by leaving the forms in place or having a membrane in contact with the concrete.

Size of Pour

If shrinkage cracks are to be held to a minimum, the size of the pour should be considered. It would be well to hold this to not more than 40 feet in any dimension. Contractors will resist this, but if the

THESE CRACKS OCCURRED AT A REENTRANT CORNER OF A BUILDING WHERE SHRINKAGE PULLS ARE AT RIGHT ANGLES. THE FIRST CRACK DEVELOPED AFTER THE FIRST SECTION OF CONCRETE HAD BEEN POURED. WITH THE SECOND POUR, THE SECOND CRACK OCCURRED.

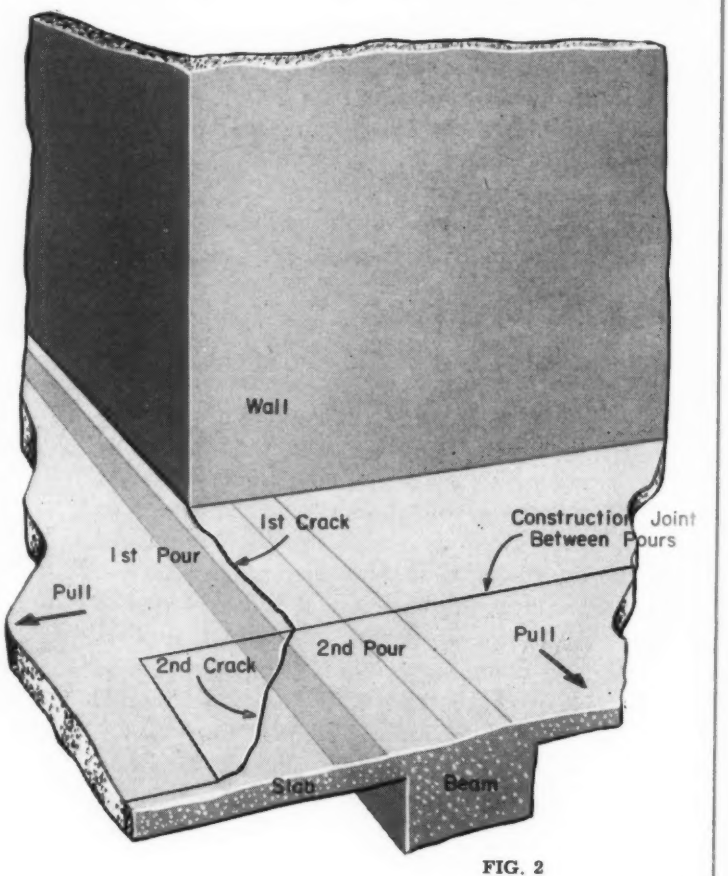


FIG. 2

job is specified this way, the engineer should give no ground. For large slab areas in a complicated framing job, it may take considerable study to locate the proper construction joints. Watch especially for construction joints in relation to openings so that an obviously weak plane is not left between the joint and opening. If the contractor wants to pour adjacent areas at the same time, an open section should be kept between the areas. The section should be filled a few days later.

Another method of pouring is by alternate areas, or checkerboard fashion. In a long narrow building, pour the areas from the ends toward the center, pouring the center area last. At least ten days, and preferably longer, should elapse between contact pours. It is important to hold to such a schedule even if the contractor tries to rush the job.

Stages of Shrinkage

Drying shrinkage of concrete extends over a period of several months and even goes on after a year when exposed to dry air conditions. Normally, one-third to one-half of the total shrinkage will take place within the first ten days using regular type I portland cement.

This shrinkage may be considered as taking place in two stages. The first stage is while the concrete is plastic — before it has taken its initial set. Shrinkage during this stage is quite rapid, depending to a great extent upon the rate of evaporation, which in turn is controlled by humidity, wind, and the size and shape of the mass. A thick slab exposed to rapid drying conditions at this time will probably crack or check.

The second stage of shrinkage is the later period of hardening after the concrete has its final set, some four or six hours after being poured. The concrete now has taken its final structural form. Shrinkage during this stage is much slower than during the first stage. This shrinkage is still due to loss of water by one of the factors mentioned. The total shrinkage may vary between 0.02 and 0.04 percent, depending on the influencing factors.

Types of Cracks

Cracks caused by shrinkage are of two types. One is a crazing crack, generally made up of three branched cracks occurring on the surface of the concrete. These are the same type seen in dried earth having a high clay content. The reason they are three branched is that this configuration permits spherical contraction. In a floor finish the cracks are caused by the finishing procedure, which brings the excess water and cement to the surface even though the concrete may have the proper mix. The same happens without finishing if there is an excess water in the mix.

The second type of crack is deeper, generally extending completely through a thin member. In a beam or slab the crack can seriously impair the safety of the member, depending on its size, extent, and location. These cracks should be surveyed by a competent structural engineer. In walls such cracks may constitute not only a serious structural condition but they also may permit water to percolate through the wall and carry away the soluble portions of the concrete—thereby making the cracks even larger. Frost action in the cracks spalls the

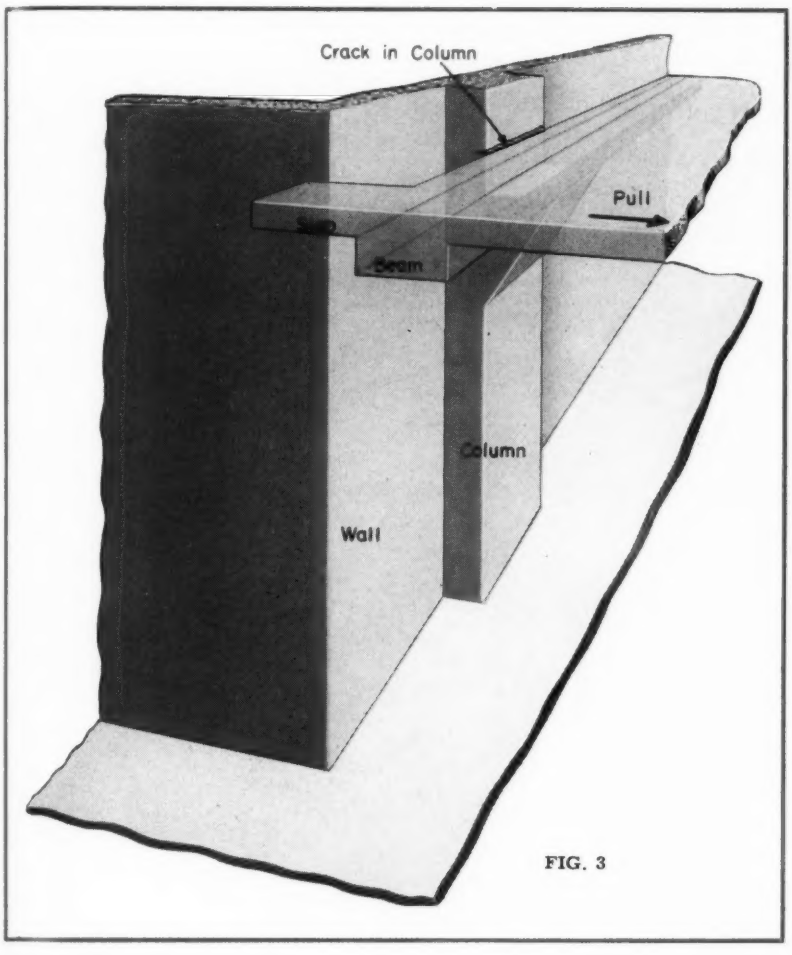


FIG. 3

HERE A HEAVY SLAB WAS FRAMED INTO A BEAM AND COLUMN, WITH OPENINGS AT EITHER SIDE OF THE COLUMN. THE OPENINGS SO WEAKENED THE CONCRETE SECTION AT THE COLUMN THAT SHRINKAGE PULLED OUT A SECTION OF THE CONCRETE.

concrete and causes disintegration of the concrete.

There appear to be two paradoxes in relation to shrinkage. One is the tendency of large specimens to crack more and shrink less than smaller specimens. The other is the effect of alkali in the cement in increasing the tendency to warp while at the same time reducing the rate of shrinkage. Also, plastic flow in concrete relieves shrinkage stresses.

All of these factors influencing shrinkage may occur on any job, but excess water and poor curing are most common. In fact, the job is a rare exception where they are not present. The main reason for sloppy work on the contractor's part is the result of his desire to save a small amount per yard in placing concrete. His main concern is a smooth surface obtained with lower labor costs through the elimination of spading or vibrating. Proper curing costs him money and inconvenience because surfaces should be kept moist and covered. Good concrete can be obtained only through rigid specifications and competent supervision.

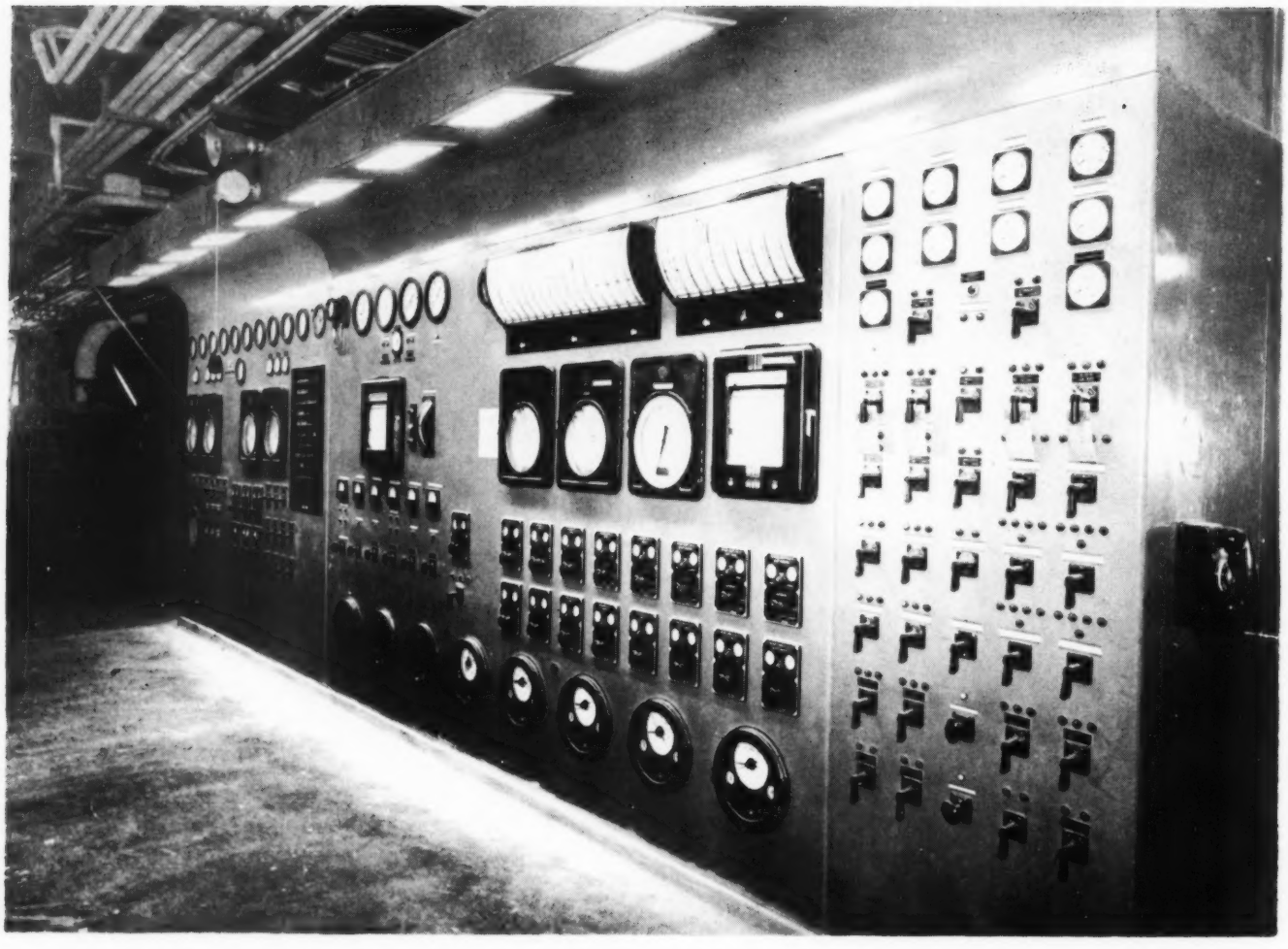
To get to specific examples may be of help. Fig. 1 shows a Z-shaped beam between two levels. With a considerable length of concrete slab extending at right angles to the beam, cracks are likely to develop as shown.

In Fig. 2 an actual condition is illustrated. This occurred at a reentrant corner of a building where the shrinkage pulls are at right angles. The first crack developed after the first section of concrete had been poured. Evidently the wall and slab dowels were strong enough to take the pull, but a weaker section along the edge of the beam resulted in the crack. A second crack occured after the second pour.

Another condition is shown in Fig. 3, where a heavy slab was framed into a beam and column, with openings at either side of the column. The openings so weakened the concrete section at the column that shrinkage pulled out a section of the column concrete. Reentrant corners on buildings are vulnerable places for shrinkage cracks, and if openings weaken the continuity, cracks will occur.

Warping of slabs poured on fill and on top of concrete or steel joists is not uncommon. The slabs are poured in sections with a construction joint between. The finishing of the slabs brings a rich mix and excess water to the surface. The finished surface then shrinks more than the bottom of the slab, which results in a curling action and warped slabs. A small difference in average shrinkage of the top and bottom portions of the slab will result in considerable curling. Improper curing will aggravate this condition because of rapid surface drying.

Even with good concrete and good supervision, shrinkage cracks cannot be eliminated from concrete work. Proper placing of construction joints can help, but location of openings, which are not usually the responsibility of the structural engineer, are difficult to overcome. An excessive number of construction joints, with small pours, will incur the contractor's ire or result in a high priced job. However, intelligent appraisal of a large job from the shrinkage point of view will result in the reduction of cracks. The main problem, of course, is to see that the contractor furnishes the proper concrete and places and cures it with some degree of interest and considerable intelligence. ▲▲



CONTROL BOARD FOR STEAM GENERATING UNIT, PORTSMOUTH POWER STATION, VIRGINIA ELECTRIC & POWER CO.

Planning Initial Operation of Power Plants

HARRY J. KLOTZ

Harry J. Klotz graduated from the University of Illinois in 1912 with the degree of B.S. in Mechanical Engineering, and he later received the professional degree of M.E. from the same university in 1932. Following graduation he spent two years as instructor in mechanical engineering at Rensselaer Polytechnic Institute; three years as operating engineer for utilities in the Illinois Traction System; and one and one half years as instructor in an aviation ground school during World War I. In 1919, he joined the Power Division of Stone and Webster Engineering Corporation, advancing to Assistant Chief Power Engineer in 1930 and Chief Power Engineer in 1940. From that time until his retirement on December 31, 1955, his duties as Chief Power Engineer included supervising the initial operation of power plants and serving as consultant on their design. He is a member of the American Society of Mechanical Engineers and the National Society of Professional Engineers.

CE exclusive

"AT 3:20 A.M. WEDNESDAY, Unit 1 in the new Power Station X of the Blank Electric Power Company was placed in service to begin supplying electricity to the company's system."

Numerous versions of this statement, with various degrees of embellishment, frequently are seen in the daily press during these days of rapid expansion of the electrical industry. In back of the terse words are stories of planning and execution not always fully appreciated by many of the people associated in varying degrees with power generating projects. To begin with, placing a unit in service during the

night points up the importance attached to avoiding delay in the initial operation of power plants.

The date when commercial operation of a plant must begin is the determining factor in the authorization of its design and construction. Planning for that goal must have a place in the scheduling of the entire program, from the beginning of design to the day of availability for service. Once this date has been set, it becomes the key point in the design and construction schedule toward which all steps must be directed.

Failure to complete a plant on schedule results in an undesirable addition to its capital cost through extension of the construction period. Also, in these days of large capacity generating units, inability to place the output of a new unit on the line may mean prolonging the operation of less efficient units or purchasing power to supply system requirements. Either of these contingencies might entail expenditures in the order of thousands of dollars per day.

Scheduling Preliminary Operation

In preparing construction schedules, the mere indication of the date of expected commercial operation is not enough. An adequate period must be allowed for the necessary preparation of the equipment for continuous dependable operation after the construction work has been completed. This usually is called the period of preliminary operation, and it requires varying lengths of time depending upon the size and complexity of the installation.

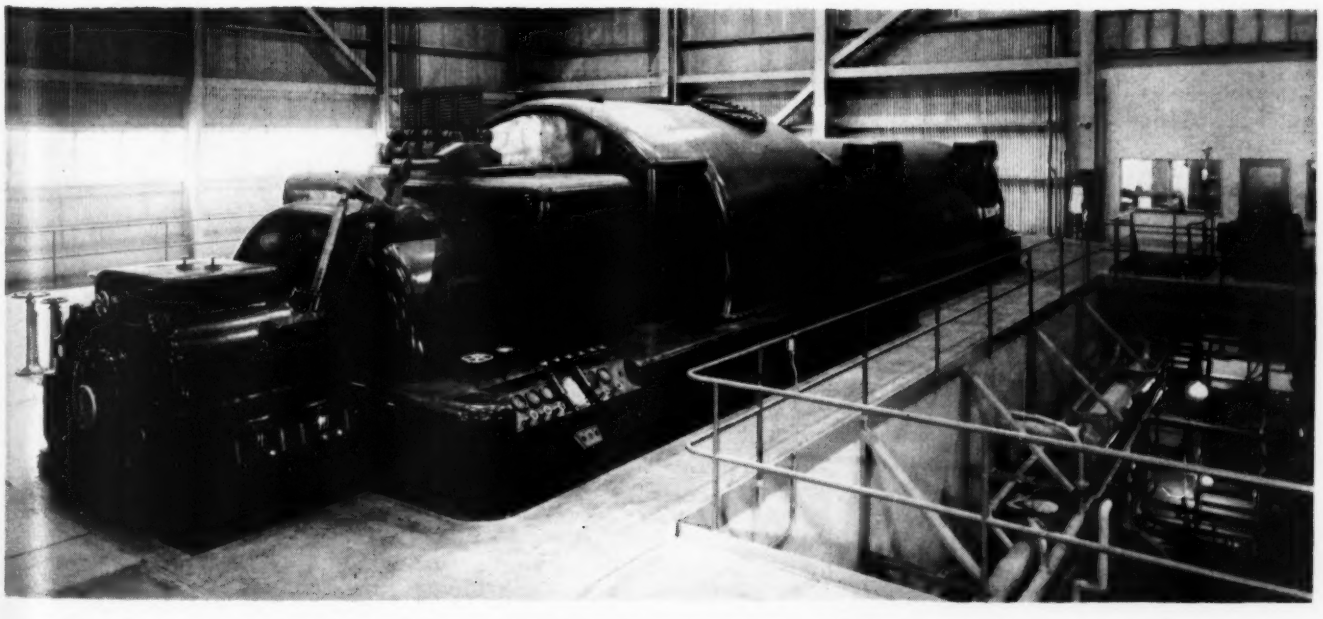
Adequate time for preliminary operation is especially important for large capacity boilers and turbines because of their interdependence when installed to operate on a unit basis. The high steam temperatures and pressures used in present day plants, where 1000 F and over 1500 psi are common values, require insuring to the utmost extent that the unit remain in service when the preliminary operation period has been completed, thereby avoiding the expense and delay incurred in frequent starting and stopping.

Preliminary Operation

Since carrying out the schedule for preliminary operation so that it culminates in dependable commercial operation on the desired date is of prime importance, it is imperative to provide for effective liaison between the construction organization and the plant operating department. The construction organization, understandably, is concerned mainly with the completion of the plant on or ahead of schedule and should not be expected to interest itself in purely operating matters. The power company's operating department naturally is interested in meeting or bettering the scheduled date for operation of the plant, but its primary attention is concentrated on operating features of the equipment.

When the plant as a whole and individual items are in satisfactory readiness, the preliminary operation serves to assure that the subsequent performance will be in accordance with design specifications. It is desirable that the construction organization and the operating department appoint engineers to cooperate throughout this period of transfer of jurisdiction. The engineer designated by the construction organization to supervise preliminary operation should be a specialist who not only is experienced in the operation of equipment, but who also is familiar with problems of design and construction. This will help prevent conflicts of interest that result in delay.

One of the first functions of the engineer assigned by the construction organization is to prepare a schedule of the sequence of the final items of con-



100,000-KW REHEAT STEAM TURBINE GENERATOR, PORTSMOUTH POWER STATION, VIRGINIA ELECTRIC & POWER CO.

Tentative Preliminary Operation Schedule
150,000 KW Unit No. 1, Power Station X, Blank Electric Power Co.

The following schedule is predicated on the dates shown for boiler hydrostatic testing and boil-out. If these dates are improved, the program can be adjusted accordingly.

Week of May 24—Rotation checks of condensate and condensate booster pumps. Inspect piping relative to these pumps. Calibrate pressure transmitters, thermometers, and gages. Operate condensate and booster pumps to flush piping and heaters from hotwell on through and out of boiler feed pump suction header. (Above work has been completed.)

Week of May 31—Rotation check of heater drain pump. Receive turbine oil and flush through reservoir and conditioner, returning to No. 5 storage tank. Operate transfer pump, conditioner supply pump, and cartridge filter pump during flushing. Flush gland seal water system. (Above work has been completed.)

Week of June 7—Operate compressors for "run-in" period. Blow and test instrument and control air lines. Continue calibration of instruments. Using booster pumps, flush through boiler feed pumps and out of 4-in. superheater desuperheater line. Continue testing instrument and control air lines.

Week of June 14 — Flush heater drain system via 1st point heaters. Set level alarm switches, controls, and level control valves on heaters and water tanks. Continue blowing compressed air lines.

Week of June 21 — Circulate through closed cooling water system. Continue blowing compressed air lines. Continue setting level instruments and valves on heaters. Calibrate control room pressure indicators. Continue testing instrument air lines. Fill steam and water flowmeters and calibrate flowmeters. Flush and fill distilled water system.

Week of June 28—Operate main circulating water system. Continue blowing cooling water and air system lines. Continue setting level instruments and control valves on heaters. Continue testing instrument air lines. Set pressure alarm switches. Calibrate fuel flowmeters. Complete setting of level instruments and valves on heaters. Operate salt water cooling pumps and heat exchangers. Complete blowing of cooling water and air system lines. Set salt water back pressure controls and butterfly control valve. Complete testing of instrument air lines. Calibrate the air flowmeters. Calibrate the furnace draft controller.

Week of July 5—Operate service water system. Prepare fill and drain lines for boiler hydrostatic test. Check and install temporary gages for hydro test. Complete Class 1 instrumentation.

Week of July 12—Hydrostatic test of boiler. Operate I.D. and F.D. fans. Set damper control drives. Set fuel control valves. Calibrate evaporator controls and set evaporator make-up control valve.

Week of July 19—Flush evaporator system. Blow gas supply lines with air. Admit gas to supply system. Set gas pressure controls and reducing valves.

Week of July 26—Operate chemical feed system. Inspect fuel oil system preparatory to preliminary operation. Operate oil tank foam system. Set combustion controls.

Week of August 2—Recirculate fuel oil by several stages until all piping between the boiler front and storage tank has had oil recirculation. Operate boiler recirculation fan. Set boiler controls, fuel oil heater controls, etc.

Week of August 9—General preparatory inspection for preboil. Move preboil chemicals to Plant No. 1 Water Treatment Area, and check boiler fill lines, etc. Check furnace draft and pressure instruments. Install temporary drum level gage and local fuel gas control for hand firing. Continue setting combustion controls and steam temperature control system. Complete Class 2 instrumentation.

Week of August 16—Boiler preboil —by means of gas fire; hold pressure at 100 psi for 24 hours, start blowdown for reduction of solids concentration. With conductivity at 800 MMHOS or less, raise pressure to 300 psi gage for main steam and reheat line blows in accordance with Description of Controls V. Complete temperature control system for turbine generator auxiliary coolers.

Week of August 23—Boiler to be thoroughly inspected to determine if acid cleaning will be necessary. Then contingent upon results of inspection of boiler, and assuming that no acid cleaning will be required, the following schedule will apply: Prepare Unit 1 for commercial operation. Light off, raise pressure to complete blowing of steam leads as outlined in Description of Controls V. Raise steam pressure, set safety valves. Roll the turbine generator unit. Complete Class 3 instrumentation.

Week of August 30—Turbine operation will proceed as follows: Roll turbine at about 300 rpm for 1 hour. Raise to 800 rpm and start stretch-out with 20-in. vacuum. Reduce vacuum by 5-in. stages at 1-hour intervals, holding 800 rpm. Raise vacuum by 5-in. stages and repeat. (Total elapsed time 8-10 hours.) Increase turbine speed to 1800 rpm, apply field for electrical test. (Total elapsed time 12 hours.) During 300-rpm run and up to ½ speed (1800 rpm) hold boiler pressure around 200 psi gage. Increase pressure consistent with unit load. Run combustion control tests concurrently during this stretch-out period. At rated speed (3600 rpm) complete electrical tests and synchronize to system. Load 10% immediately. Increase load 10% each 4 hours until at 50% rated load. (Total elapsed time 24 hours.) Complete this phase in approximately 48 hours.

Week of Sept. 6—Drop load, inspect bearings, charge generator with hydrogen. (Total elapsed time 2 to 3 days.) Take turbine up to full load, check controls and make all tests preparatory to release to Dispatcher. Operate fuel oil burning system.

struction that are related directly to the initial phases of operation. Such a schedule, which will need to be reviewed and revised periodically as work progresses, is of incalculable benefit in expediting construction and initial operation.

A typical preliminary operation schedule is presented in the accompanying table. This is actually the first revision of a schedule that had been prepared about three weeks earlier, but it illustrates the many details and the length of time required.

During completion of the final phase of construction, the liaison engineer should pay close attention to operating convenience, as any alterations that may be advantageous can be made at this stage of the program. Often it is not feasible to show some features in detail on the plans, and these are left to be located or arranged in the field. Other features may require a change from the planned arrangement on the basis of practical considerations.

Training the Operating Personnel

Advantage should be taken during this stage of the construction to train the men who are to operate the equipment. It has been found to be very helpful to have the entire crew of operators available on the day shift for a training period of suitable duration. This permits them to become familiar with the equipment prior to the start of preliminary operation. Equipment data books, flow diagrams, and instruction manuals should be available, supplemented by organized classes of instruction conducted by the preliminary operation engineer, members of the power company's staff, and representatives of manufacturers of the principal equipment.

As erection of individual items of equipment is completed, attention should be concentrated on their preparation for operation. For the rotating equipment this phase covers checking of alignment, inspecting and cleaning of internal parts, and providing for lubrication. Piping and duct systems are cleaned carefully. Thorough flushing of all lines in water systems is imperative. This is supplemented by the installation of temporary strainers in the suction connections of all pumps. The strainers should be inspected and cleaned frequently, and usually they should be left in place for a minimum of about one week at maximum flow rates.

Cleaning of main steam piping is especially important. This is done by blowing the lines with steam after the boiler has been "boiled out" and made ready for service. A carefully planned program with special arrangements of temporary piping is essential for the blowing of steam lines, and the work always should be carried out under the close supervision of the personnel responsible for the condition of the piping.

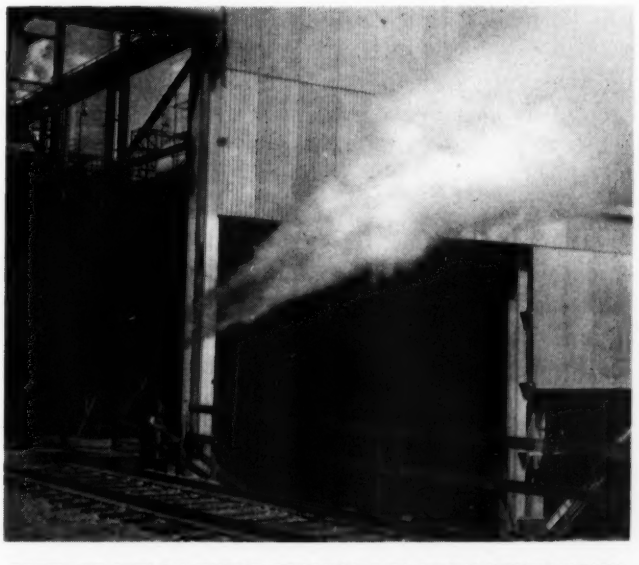
During the trial operation of each item of equipment, a service engineer of the equipment manufacturer should be present to observe conditions and to supervise all adjustments and corrective steps. All manipulation of controls, starting with the initial trial operation of equipment, should be done by the plant operators with construction personnel available to make necessary adjustments.

Cleaning the Boiler

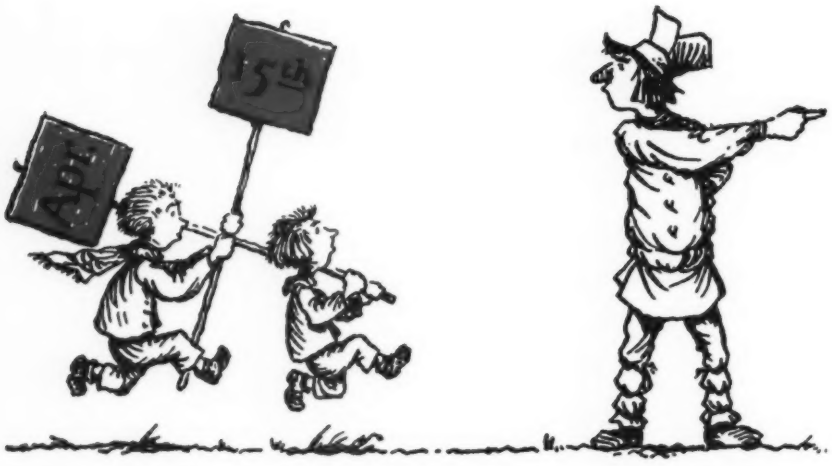
Thorough internal cleaning of the boiler is another vital step in the preliminary operation program. The actual boiling out process has long been customary. Now it frequently is supplemented, especially where higher pressure units are concerned, by cleaning with acid that has been treated with an inhibitor to prevent damage to the boiler metal. It is essential that both the boiling out and the acid cleaning procedures be conducted in accordance with programs carefully prepared in advance. Acid cleaning never should be attempted except under the direction of a trained and qualified organization.

It also is important to provide for chemical supervision of the condition of the water used for boiling out and for the initial operation of the boiler. In fact, the services of a water treating consultant frequently are employed during initial operation to inaugurate a program of water conditioning. This helps to avoid the possible corrosive action to which the internals of boilers operating at high temperatures are susceptible.

It would be folly to attempt to cover all details of even the most important items related to the initial operation of power plant equipment. However, this brief summary will serve to point out that while the design and construction of modern power plants require skilled attention, initial operation also deserves careful planning and supervision. ▲▲



VIEW OF STEAM BEING DISCHARGED FROM TEMPORARY PIPING WHILE BLOWING OUT THE MAIN STEAM LINE SERVING UNIT NO. 5, AT PLANT NO. 2, REDONDO STEAM STATION, OF SOUTHERN CALIFORNIA EDISON COMPANY.



Your Partnership and The Tax Law

ELI GERVER, C.P.A.

PRIOR TO PASSAGE of the Internal Revenue Code of 1954, treatment of partnerships was one of the most confused in the income tax field. There was little statutory material and almost as little in the way of official interpretations and court decisions. The 1954 Code is the first comprehensive statutory treatment of the problems inherent in the partnership form of business.

Taxation of Partnership Income

The law has not changed the basic technique of taxing a partnership. The firm, as such, is not subject to tax. An annual return, for information purposes, is required. The firm reports its income and deductions and in supporting schedules gives the distribution of the partnership income. In preparing this distribution, items subject to special tax treatment (capital gains and losses, dividends, tax-exempt income, contributions, and similar items) are split among the partners separately from the rest of the income and deductions. Each partner then reports his share of income and special items, with the income and deductions he may have apart from the firm. Special items are treated in his return as though he had received or paid them personally.

For example, contributions made by the firm are distributed among the partners. Each partner shows his share of these firm contributions along with contributions he personally made, and he receives the combined deduction. If the firm also had capital gain, each partner shows his share on his return as though it were a personal transaction. If he had capital losses, he offsets them against this gain. If the firm had no other special items but had other income and deductions, the net amount is divided among the partners. Each partner's share is added to the non-partnership items in his return, for example: interest, dividends, and income of spouse (where a joint return is filed). Each partner may have widely differing amounts of total income even though they are sharing partnership profits equally.

Thus, the tax on partnership income depends on the tax bracket of each individual partner and will, of course, vary considerably.

Income Distribution

The manner of distributing the income and loss and other special items is determined by the partners. Virtually any agreement that does not have the primary aim of evading taxes will be acceptable. For example, an attempt to give all income from tax-exempt municipal bonds to a partner in a high tax bracket would probably be considered a tax evasion scheme, and the government would reallocate the tax-exempt income among all partners.

The method of distribution selected by the firm can be changed at will. The law permits a change in the allocation of income and special items at any time. In fact, changes can be made so as to affect distribution of income for the past year of partnership's operations, provided the change is made by the due date of the partnership return — for example, April 15, 1956, if the partnership reports on a calendar year.

When Taxed as a Corporation

One change of the 1954 Code is the new right of a partnership to elect to be taxed as a corporation. The statute granting this right raised many questions that are, as yet, unanswered. Unfortunately, the privilege of election is limited, and it is doubtful if many professional firms will be able to take advantage of this interesting provision. The principal stumbling block for a firm of engineers is the statutory requirement that capital be a material income-producing factor of the firm. Engineers, as is true for most professional firms, deal primarily in services, and capital is ordinarily only a minor factor.

Selection of a Fiscal Year

Another change in the law is of considerably greater importance. In the past a firm could be created and a fiscal year selected at random. The only requirement was that the year end on the last day of a month. The law now requires that the

reporting year of a new partnership may not be different from that of partners with a 5 percent or greater interest, nor may an existing firm change to a reporting year different from that observed by its 5 percent partners.

The significance of this change can be appreciated when we recall how a partner is taxed on his income from the firm. Each partner is required to report his proportionate share of the total partnership income. When the firm year ends on a different date from the partner's, he reports his share for the year of the firm that ends with or within his year. Thus, assume A and B formed A-B Company, a partnership, on June 1, 1950. As individuals, they filed their returns on a January to December year. Under prior law, they could select a fiscal year ending May 31. On filing their returns for 1950, A and B would show no income from A-B Company, as the partnership year had not ended in 1950. (A-B Company's first year ends May 31, 1951.) In their returns for 1951, filed in 1952, A and B would first report income from A-B Company. This deferral of tax on the early months of activity was of great assistance in business planning. Today, A and B would have to select a partnership year ending December 31, and there is no deferral of tax.

Tax considerations aside, it is possible you may want to end your partnership year at a date other than December 31. One way of overcoming the statute would be for the partners to request permission of the government to change their personal reporting year to coincide with the year selected for the firm. For example, if you want to end the firm's year on May 31, the partners would obtain permission to file their personal returns on a year ended May 31 instead of the conventional December 31. A word of caution — if you do this, your wife's year should also be changed. The right to file a joint return is lost if the husband and wife use different reporting years. The resultant loss of the privilege of income-splitting could be quite expensive.

Limits on Partnership Losses

Unfortunately, a firm does not always make money; there are losses occasionally. The partners share their losses as well as their income and deduct them on their individual returns. The amount of loss that any partner may deduct, however, is limited to his investment in the firm. It should be realized that "investment" for this purpose is not restricted to cash or property invested in the firm. Other factors are earnings of the firm, withdrawals by partners, and changes in the firm's liabilities.

The excess of a partner's share of the loss over his investment may be taken in the year he repays the firm the difference. This may be in cash, property, or out of his share of a later year's profits. For example, P's investment is $5,000 and his share of the loss for 1955 is $7,500. In his 1955 return, he can deduct only $5,000. If in 1956 he leaves in the firm $2,500 of what would be his share of profits, he may deduct the $2,500 in 1956.

Eli Gerver, C.P.A., currently is Assistant to the Director of Taxation, American Institute of Accountants. Prior to assuming his present position, he had eight years of professional experience in public accounting. He also serves as a lecturer in accountancy at City College, N. Y.

Partner's Drawings

As a rule, partners receive periodic sums of money from their firm. If these sums are considered by them to be an advance against a partner's share of profits, the partner prepares his tax return without considering how much he received during the year. Frequently, however, such sums are intended to be a salary payment and are intended to be paid whether or not the firm has profits. In this event, the partnership treats such payments in its return as salaries paid to any employee; the partner adds such amounts to his share of partnership income in his return.

Although the partner's salary is here treated as any employee's, the partner is not an employee. The firm is not required to withhold income tax or pay social security taxes. Far more serious from the partner's point of view is the fact that he is not considered an employee for purposes of setting up a pension or profit-sharing plan. (Special tax privileges may be granted to such plans that are set up *solely* for employees.) Contrast this with a corporation where the officers are considered employees without regard to their stockholder status.

Retirement Plans

In this connection, a bill now before the Congress has the solution of this problem as its aim. Within limits, this bill would permit a deduction up to $7,500 a year for premiums paid by an individual for a retirement plan. When the payments are received after retirement, tax is paid on the amounts as received. Engineers and other professional groups are vitally interested in this bill. The self-employed professional has difficulty in saving enough after-tax dollars to permit retirement. The present tax law permits him to take care of his employees but not himself. The proposal currently before Congress is intended to remove this disparity. Its provisions closely parallel treatment of pension and profit-

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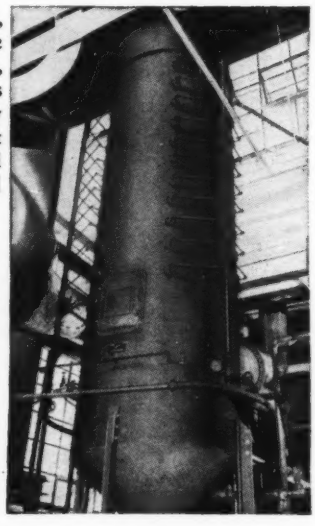

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Father and Son Partnership

The proudest day in the life of a professional man is the day he can form a partnership with his son. In so doing, care must be taken not to give the son a share of income that is in excess of the reasonable value of his services, unless the firm employs income-producing capital that may be transferred by gift. Otherwise, the government will contend the partnership is not valid and is merely a device to evade taxes. For example, if X, Jr. is an engineer whose services to the firm are worth $15,000, his share of the total income should be no more. Presumably, the balance of the income was earned by services of X, Sr. The government carefully scrutinizes father and son partnerships in engineering and other professional fields.

Planning Your Tax

In virtually every discussion of taxes, the question inevitably arises: How do I reduce my taxes? There is no simple answer, but there are some things that can help. Do not start to look for ways to lower your tax at the end of the year. Low taxes require careful planning throughout the year. Records of business activity should be complete and carefully kept. If you engage a tax attorney or a certified public accountant, consult with him regularly rather than just at the end of the year. The tax saving can more than offset any additional cost of such services. Above all, do not try to solve your complicated tax problems alone. Taxes are too costly; the field is constantly changing, and the retention of a properly qualified advisor cannot be too strongly urged. ▲▲

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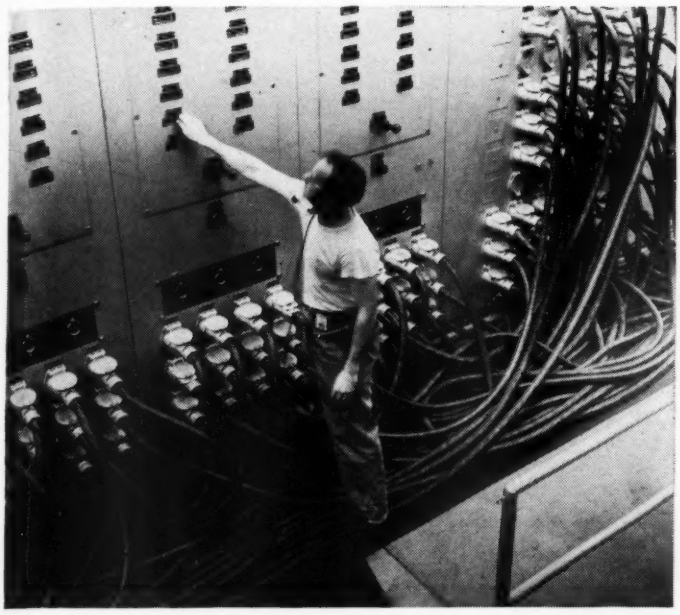

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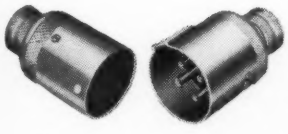

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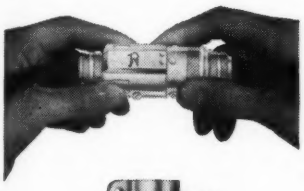

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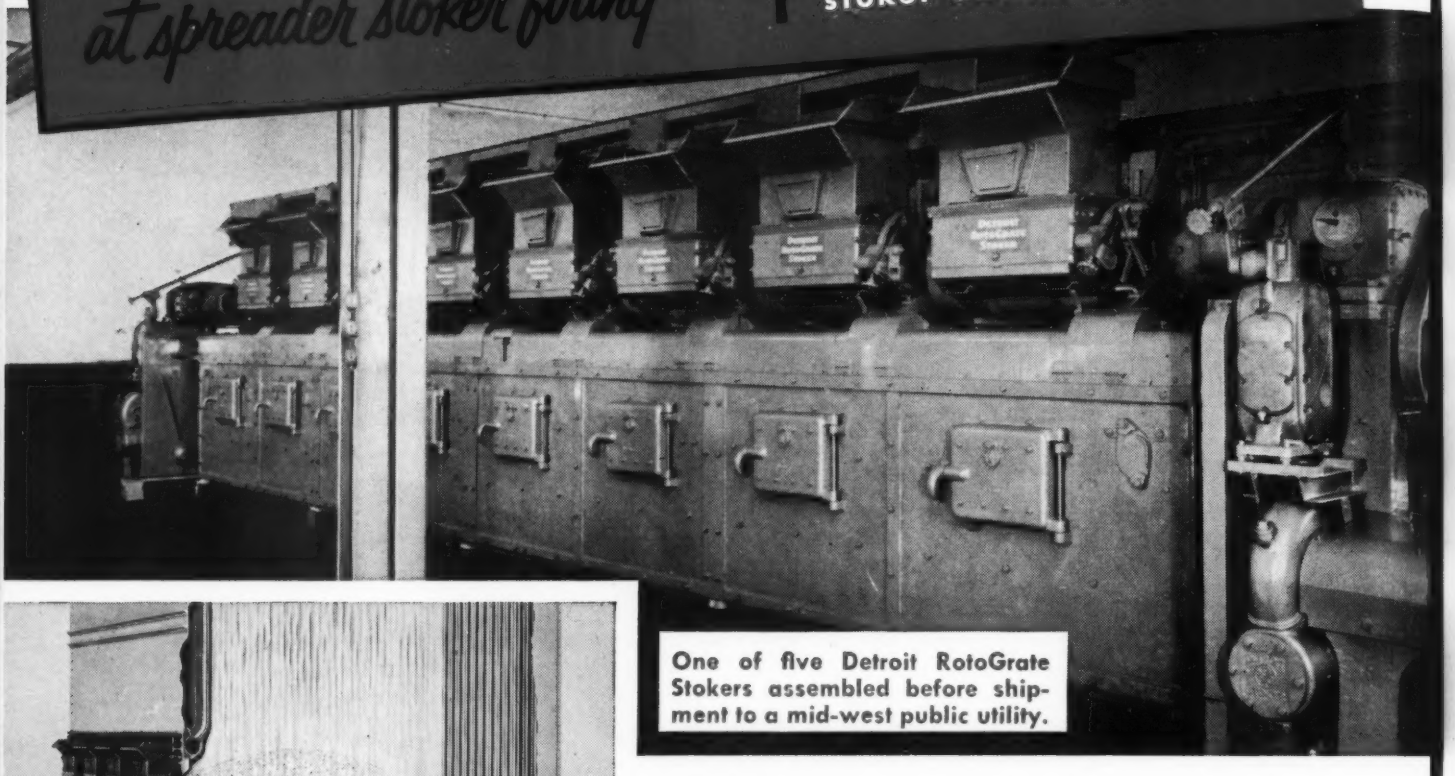


One of five Detroit RotoGrate Stokers assembled before shipment to a mid-west public utility.

Detroit RotoGrate Stoker with two of the six Rotors removed to show the overlapping highly restricted grate designed especially for spreader stoker firing.

- **High Burning Rates** per square foot of grate a permit continuous operation with less expens boiler and furnace design
- **Low Carbon Loss** results in high over-all efficie
- **Superior Design** permits operation with low cess air
- **Wide Load Range** handled smokelessly with a vertible grate area
- **Low Maintenance** compared to other coal-burn methods.
- **Burns All** bituminous coals and Lignite. Also ba wood, bagasse and other refuse fuels, either s arately or in combination with coal

• Contact our nearest District Office or your consulting engineer.

Backed by over a half century of experience. Complete manufacturing and service facilities.

DETROIT STOKER COMPANY

General Motors Building — Detroit 2, Michigan

District Offices in Principal Cities • Works at Monroe, Michigan

The Consulting Engineers Associations — A Tabulation of Organization

Compiled by THOMAS E. ROCHE

Tom Roche, consulting engineer of Minneapolis, Minnesota, has done as much as any man to bring consulting engineers to a realization of the importance of working together to better their business opportunities and improve their professional standing. He was one of the founders of the Minnesota Association of Consulting Engineers, and he is a past president of that organization. He is currently Chairman of the Extension Committee, the man responsible for increasing their membership and carrying the idea of association to others outside Minnesota. He is also Secretary of the National Steering Committee appointed to write the preliminary constitution and bylaws for a National Federation of the several Associations whose organization is described in the table below.

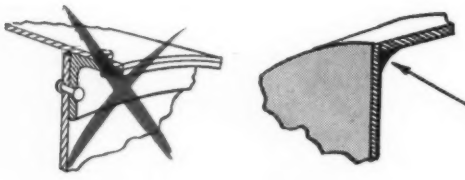
PARTIAL SUMMARY — CONSTITUTION AND BYLAWS — CONSULTING ENGINEERS ASSOCIATIONS — 1955

Location	*Name of Association*	*Number of Members*
California	Consulting Engineers Association of California	170
Chicago	Chicago Association of Consulting Engineers	35
Colorado	Consulting Engineers Association of Colorado	30
Louisiana	Gulf Institute of Consulting Engineers	25
Minnesota	Minnesota Association of Consulting Engineers	100
Missouri	Missouri Association of Consulting Engineers	30
New York City	New York Association of Consulting Engineers	50
Oklahoma	Consulting Engineers Association of Oklahoma	20
Texas	Texas Association of Consulting Engineers*	17
Upstate New York	The Association of Consulting Engineers of Upstate New York	12 Firms
Utah	Intermountain Institute of Consulting Engineers	17

*Texas does not have a state organization as yet. Information in this table is for the Dallas-Ft. Worth Chapter. In addition, there are chapters at Houston and San Antonio.

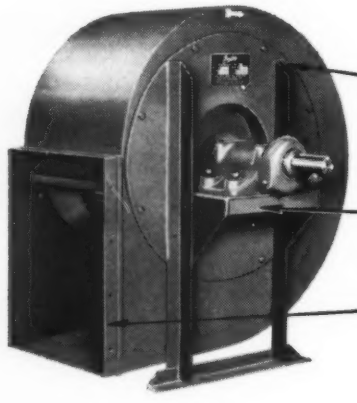
	Calif.	*Chi.*	*Colo.*	*La.*	*Minn.*	*Mo.*	*N.Y.C.*	*Okla.*	*Tex.*	*U.N.Y.*	*Utah*
General Information											
Association is incorporated	X	X			X			X			
Association has chapters by localities						X			X		
Association uses AICE Canons of Ethics as standard		X		X							
Association uses ASCE Code of Ethics as standard											X
Association uses ECPD Canons of Ethics as standard	X										
Qualifications for Membership											
Must be licensed and registered	X	X	X	X	X	X	X	X	X	X	X
Must be actively engaged in professional engineering practice	X	X	X	X	X	X	X	X	X	X	X
Must be actively engaged in preparing plans and specifications			X						X		
Must be registered in state of his residence	X		X	X				X	X	X	X
Must be registered in area of his association	X		X	X		X		X	X	X	
Must not be connected with sales	X	X	X	X	X	X		X	X	X	X
Must not be salaried employee of private or public organization	X		X	X	X	X		X	X	X	X
Must not be in any other business			X	(a)	X			X		X	X
Can be member of engineering corporation	X		X	X	X	X		X	X	X	X
Must be principal in C. E. firm			X	X	X	X	X	X	X	X	X
Must share directly in firm's profits and losses	X			X	X	X		X			
Must have acceptable place of business	X	X	X	X	X	X	X	X	X	X	
Income must be from fees charged for services	X			X		X		X	X		
Must have attained minimum age (figures are years)		32		30		32					
Must have acceptable experience (figures are years)		10		(b)		10	2				
Must have been in private practice (figures are minimum years)										2	
Must be member of his Founder Society				X							
Association has special society membership requirement			(c)			(d)					
New member must file application form	X		X	X	X	X	X	X	X	X	X
New member must be sponsored		X	X	X	X	X	X	X		X	

Bayley FAN-A-GRAFICS
For Equipment Engineers

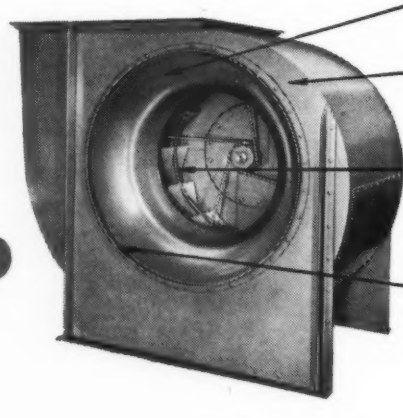


Craftsmanship

Presented here for your information are some basic facts revealing how superior quality Fans are built by a manufacturer credited with a long history of fine craftsmanship in production.



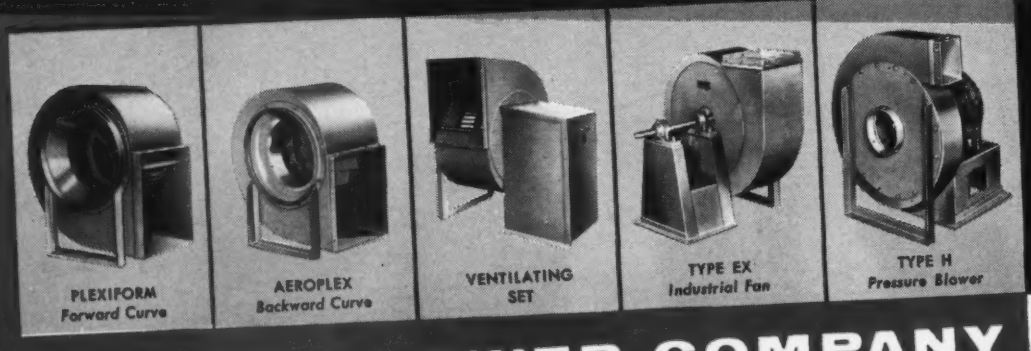
FEATURE	FUNCTION	BAYLEY Standards
Strong, light, continuous inside-welded housing seams, with smooth, neat exterior.	To avoid leaks, springing, warping, crinkling, vibration. Easily painted or insulated for seamless, trouble-free protection.	All types and sizes of fabricated steel housings.
Reversible Housing	Quickly available for any discharge position, permits field changes, simplifies or eliminates detailed preliminary layouts.	Type F and AP Fans to size 365 inclusive. Other styles to maximum practical.
Fabricated Brackets	Durability, maximum strength-weight ratio, matched to specific load requirements.	All types and sizes except very small fans.
Reinforced, system-ready outlet piece.	Quickly-made, tight connections. No "field manufacturing" required.	All types and sizes.



Smooth-spun, closely fitted Housing and Wheel Inlets.	Minimize turbulence and recirculation losses, provide maximum *realized* efficiency.	All AP Fans.
Ample Housing Side and Scroll Gauges (Made practical and effective by seam-welding.)	Uniformly high strength, stiffness, and corrosion resistance minimizes "breathing", vibration, perforation.	All types and sizes.
Accurately Prepared and Applied Wheel Blade and Shroud Reinforcement.	Maximum strength with minimum shaft load reduces moment of inertia, facilitates precision balance, minimizes vibration.	Type F and AP Wheels, according to size and speed.
System-ready Inlet Ring of ample length and stiffness.	Facilitates quick connection to inlet duct or accessory, originally or at a *later time*. System can be altered or extended without reconstructing or modifying fan.	All types and sizes. (Need not be explicitly specified.)

You'll find all these as well as many other quality features in BAYLEY Fans. Send for Complete Line Bulletin CL-551.

Our 100th Anniversary of Craftsmanship



Engineered
AIR HANDLIN
EQUIPMENT

BAYLEY BLOWER COMPANY

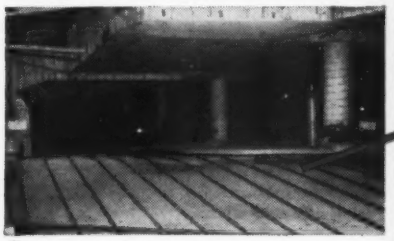
CONSULTING ENGINEERS ASSOCIATIONS —

	Calif.	Chi.	Colo.	La.	Minn.	Mo.	N.Y.C.	Okla.	Tex.	U.N.Y.	Utah
Membership Classifications and Limitations											
Association has full members				X	X	X			X		
Association has inactive members						X					
Association has associate members					X						
Association has life members, or provisions for life members							X		X	X	
Association has honorary members				X							
Association has no special designations	X		X					X		X	X
Ass'n limits membership from one corporation (figure is maximum)	2										3
Ass'n limits membership from one partnership (figure is maximum)											3
Association is limited to specific area (figure is radius in miles)		50		(e)			60				
Association accepts members outside specified area		X		X							
Branches of Engineering Included in Membership											
Civils	X	X		X	X	X		X		X	X
Chemicals	X	X		X	X	X		X		X	X
Mechanicals	X	X	X	X	X	X	X	X	X	X	X
Electricals	X	X	X	X	X	X	X	X	X	X	X
Structurals	X		X	X	X	X	X	X		X	X
Soils											X
Others		X			X	X				X	
Employees of engineers (associate members)					X						
Annual Dues in Dollars											
Maximum or for full member. See footnote (f)	500	15	25	100	15	10	75	20	5	25	20
Inactive members						5					
Associate members					7.50						
Life members									5	None	
Initiation fee	25	15	75	100	2	25	25	50	10	25	
Initiation fee—applied on 1st year's dues if accepted											10
Reinstatement fee						10					
Special Assessments											
By ⅔ vote of entire membership		X									
By majority vote of board and members in meeting							X	X			
By ⅔ vote of board and members in meeting						X					
By ¾ vote of board—assessments against full members only					X						
By majority vote of board										X	
By majority vote of executive committee									X		
Association has assessment limit (figure is dollars)	25										
Administration											
Board of directors	X		X		X	X		X			X
Officers				X			X		X	X	X
Past president—member of board			X		X			X			X
Past president—member of executive committee									X		
Officers											
President	X	X	X	X	X	X	X	X	X	X	X
1st vice president	X	X	X	X	X	X	X	X	X	X	X
2nd vice president				X			X				X
Secretary-treasurer	X	X	X	X				X	X	X	
Secretary						X	X				X
Treasurer					X	X	X				X
Term of office in years	1		1	1	1	1	1	1	1	1	1
Board elects officers	X										
Term of board in years	2			1	2	3		1			
Membership elects officers			X	X	X	X	X	X	X	X	X
Vacancies filled by board	X				X	X		X			X
Board can call election to fill vacancies				X							
Secretary appointed											X
Secretary-treasurer appointed by president	X										
Executive secretary appointed by board	X			X							X
Only one member of any firm can be an officer at any one time			X	X	X	X		X	X		
Voting limited to one member per firm						X	X		X	X	
Absentee ballots allowed				X			X	X	X	X	
By letter	X			X			X	X			X
Fiscal Year											
January to January	X			X		X	X	X			
April to April									X		
June to June										X	
July to July					X						X
September to September			X								

...another WROUGHT IRON PIPE snow melting system

● Wrought iron pipe grids installed in park paths

● Wrought iron pipe serving step snow melting system



● Wrought iron pipe in garage access ramp system

At MELLON SQUARE PARK and GARAGE

pedestrian and parking traffic enjoy summer surfaces during winter snows

Take a six-level parking garage . . . top it with an inviting park . . . then place it in a hole the size of a city block in the middle of busy Pittsburgh's Golden Triangle . . . and you have all the ingredients necessary for trouble when winter snow starts falling . . . UNLESS a lot of thought is given to automatic, efficient snow removal.

Designers of beautiful Mellon Square Park and Garage *did* a lot of thinking about snow removal. The location and function of the new park and garage demanded year-around utilization. To meet the need, a wrought iron pipe snow melting system was installed in the walks and steps of the park area, and all driveway ramps leading into and out of the garage. The result—safe walking surfaces for pedestrians and skid-free access ramps for the parking traffic. More than four miles of corrosion-resistant wrought iron pipe was used. This time-tested material was also used for soil, waste, and vent lines in the garage.

Our bulletin, *Wrought Iron Pipe for Snow Melting Systems*, gives complete information. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world.

THE H. K. FERGUSON CO., Cleveland, Ohio, in joint venture with MORRISON-KNUDSON CO., INC., of Boise, Idaho, designed and built the garage and handled the construction of the park.

MITCHELL & RITCHEY, Architects, Pittsburgh, Pa., designed the park, and were associate architects on the garage structure.

HARRY DOUGHERTY & SONS, Freeport, Pa., handled the park snow melting contract.

LANGDON & KASCHUB, Pittsburgh, Pa., installed the garage snow melting system.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS

CONSULTING ENGINEERS ASSOCIATIONS —

	Calif.	Chi.	Colo.	La.	Minn.	Mo.	N.Y.C.	Okla.	Tex.	U.N.Y.	Utah
Rules of Order											
Roberts Rules of Order		X		X	X	X		X	X	X	X
Cushings Parlimentary Rules			X				X				
Constitutions & Bylaws—ASME		X									
Quorum											
None designated						X	X	X			X
Percent of membership	33	33	25		20					60	
Percent of voting membership									50		
Majority of those present or represented by proxy				X							
Board Meetings											
Called by president	X		X	X	X	X	X	X			X
Called by vice president						X					
On monthly basis					X	X					
On quarterly basis								X			
Called by board of governors						X					
Membership Meetings											
Average number of regular meetings per year	12	4	4	5	8	4	5(min)	4	12	3	
Month of annual meeting	(g)	Jan	Sept	Jan	May	Nov	Dec	Oct	Mar	June	Mar
Meeting dates set by board				X			X				X
Meeting dates set by constitution					X			X	X		
Meeting dates set by bylaws	X				X	X					
Meetings called by president			X	X							
Special meetings called by president	X	X	X			X	X	X	X	X	
Special meetings called by board	X				X	X		X			X
Special meetings called by request of 3 members		X					X	X	X	X	
Special meetings called by request of 5 members				X							
Special meetings called by request of 15 members	X										
Special meetings called by request of 10-percent of members					X						
Standing Committees											
Executive				X		X			X		
Auditing			X					X			X
Program		X	X		X	X	X	X		X	
Membership	X	X	X	X	X	X	X	X	X	X	X
Fees and salaries						X					
Policy and practice				X	X	X					
Public relations	X				X	X				X	X
Finance		X			X	X					
Amendments		X									
Publicity		X			X			X		X	
Fees and contracts			X	X			X			X	
Architectural cooperation				X	X		X	X			
Technical							X				
Education					X			X			
Legislative	X	X		X	X						X
Extension					X						
Constitution					X						
Ethical practices	X			X	X			X			X
Fees and services	X	X		X							
Nominating	X										
Intersociety relations				X							X
Special Committees											
Interprofessional and public relations			X	X					X		
Professional practice			X								
Nominating				X					X		X
Yearbook											X
Incorporation and bylaws											X

(a) Members may be affiliated with another business if it is secondary and for investment only.

(b) Experience requirements are the same as required by applicant's Founder Society.

(c) Must be member of Structural Ass'n. of Colorado, or Cons. Mech. Engrs. Ass'n. of Colorado, or Cons. Elec. Engrs. Ass'n. of Colorado.

(d) Must be member of Missouri Society of Professional Engineers.

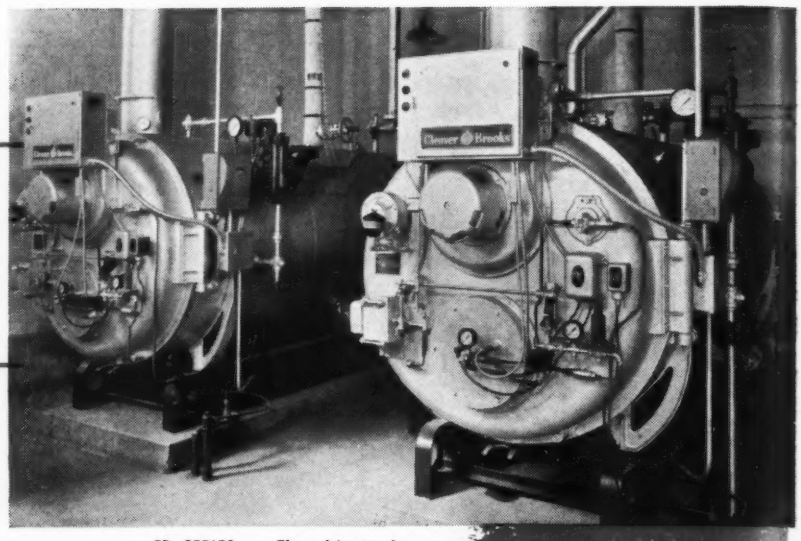
(e) Gulf Institute plans to cover Louisiana, Mississippi, Alabama, and Texas.

(f) California's annual dues are assessed in accordance with a sliding scale, ranging from a minimum of $60 for net incomes of $10,000 or less to a maximum of $500 for incomes of $60,000 and over.

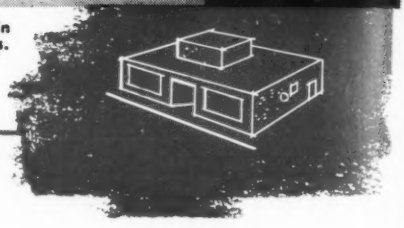
Gulf Institute's dues are fixed annually by the board of directors, being $100 at present. The $100 initiation fee, however, is written into the bylaws, and it may or may not be applied on the 1st years dues at the option of the board of directors.

(g) Annual meeting is in October or November or January as determined by board at membership's direction.

18 sizes
110 models
15 to 600 hp

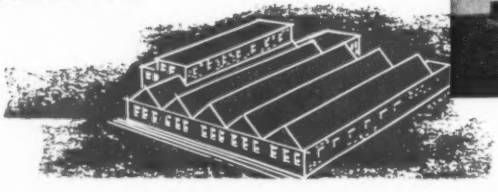


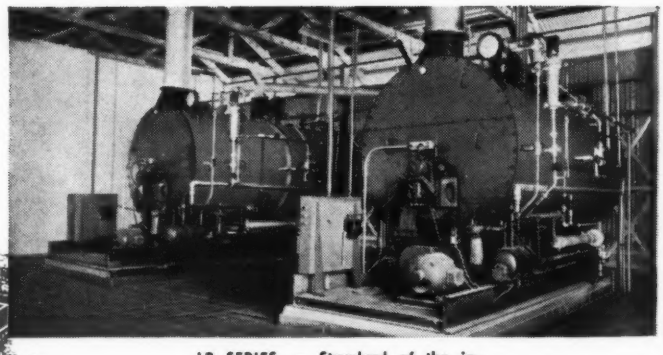
CB SERIES — The ultimate in compact, quiet-running boilers. Sizes: 15 to 150 hp.



yours from Cleaver-Brooks

the broadest line of cost-saving "packaged" boilers—for hundreds of applications





LR SERIES — Standard of the industry for hot water or steam service, for heating or processing. Sizes: 200 to 600 hp.

THE two installations above are representative of Cleaver-Brooks' broad range of standard models. The wide choice makes planning and selection of a boiler for your specific needs — large or small — a simple, time-saving procedure.

Your nearby Cleaver-Brooks representative, with years of specialized boiler experience, can be of real service to you. Working with you and your engineers, he can help you to find ready answers to questions of size, loads, present and future steam or hot water needs, space and equipment arrangement. Where local conditions dictate, oil, gas or combination oil/gas firing can be selected for greatest savings. And once installation is completed, arrangements are made for factory-supervised starting and training your operator.

Keep in mind, too, the many fuel and maintenance-saving advantages of four-pass design with forced draft . . . the standard equipment electronic combustion controls which assure continuous, safe operation.

Cleaver-Brooks boiler owners enjoy all these advantages and share in the combined application engineering experience of more than 19,000 individual boiler installations. Put this experience to work for you. Cleaver-Brooks Company, Dept. C, 320 E. Keefe Ave., Milwaukee 12, Wis., U.S.A., Cable Address: CEEBEEWEST — all codes.

See the classified pages of your phone directory for name of nearest representative. Send us your name to receive regular issues of the new Cleaver-Brooks Bulletin, or write for newest literature.

Cleaver Brooks®

TWENTY-FIVE YEARS OF LEADERSHIP
BY THE ORIGINATORS OF THE SELF-CONTAINED BOILER

THOMAS H. MARTZLOFF
McKinsey & Company

Mr. Martzloff is native to the Pacific Coast. After receiving his B.S. in Engineering at Stanford University, he obtained his Master's Degree in the Department of Business and Engineering Administration at M.I.T. Since that time he has been associated with the San Francisco office of McKinsey & Company, a national firm of management consultants, serving clients on a variety of top management problems in the fields of organization, personnel, and manufacturing operations.

Staff Engineers Can Become Managers

EVEN WITH increasing availability of scientific management tools, there is ample evidence to suggest that successful managership is still an art—and a difficult one at that. Good engineers cannot always become good managers any more than brilliant salesmen can always make successful sales managers. In short, managers are almost never effective solely because of special abilities or skills. There is a chasm between a man's technical competence to do a job well and his ability to direct others successfully in performing work. Proficient management calls for a different body of knowledge.

Consulting engineering firms, like other enterprises, are concerned about their engineers bridging this gap from "doer" to "manager." Top management in these firms want to know how to develop their staff engineers into capable managers of other engineers and eventually qualify them for top management responsibility.

Engineers themselves are puzzled by this same riddle. Their interest was pointed up recently in the replies to a questionnaire that an outstanding Pacific Coast engineering school sent to its alumni. The school was particularly impressed by answers to this question: "When you come in contact with recent graduates of our engineering school, what kinds of training do you feel they need most to overcome their typical shortcomings?" Out of the ten most popular answers, the following ranked second, third, and fourth respectively:

¶ A better command of the English language, both written and oral.

¶ A better appreciation of human relations, cultural subjects, and liberal arts.

¶ A broader understanding of business management in general, including such subjects as business economics, law, accounting, salesmanship, and training in leadership.

It seems significant that these shortcomings should be foremost in the minds of a large segment of engineers. But experience of the business world shows that the transition from engineer to manager—while far from automatic—can be made. On

every hand we see industrial executives and partners in engineering firms who stand out as successful managers.[1]

Is There an Engineer Type?

A more revealing inquiry might be: "Are there any personal characteristics or patterns of behavior that tend to distinguish practicing engineers from individuals in other occupations?" And, if so, "Which of these characteristics have an important bearing on a good engineer's chances of becoming a successful manager?"

As with every group boasting some uniformity of background or mutuality of interest, engineers, generally, conform to certain describable patterns. Although each engineer obviously possesses individual characteristics that mark him from his fellow engineers, there remain some distinguishing aspects of the profession as a whole.

Men of engineering training who are practicing their profession successfully have good brains. They have been taught and have learned to think logically. They hold this advantage in common with successful managers. This ability to think logically is a valuable asset to any man who aspires to a position at the executive level.

Beyond this, there seem to me to be three other distinguishing features which can directly influence the probability that an engineer will rise to a position of management responsibility. These features assume major importance because, if for no other reason, the business world believes they are typical of practicing engineers.

The Engineer's Personality. The typical engineering personality is likely to be at odds with the type of personality most frequently associated with management men. Often the practicing engineer primarily is interested (and has been since boyhood) in "things"—things that respond in a straightforward, logical manner, as X plus Y equals Z.

Many engineers firmly believe that as long as they have the facts and are adept at using mathematical logic, nothing else is necessary to solve problems successfully. They feel that conclusions based on sound scientific foundation should be obvious to anyone with the mental ability to grasp ordinary deductive reasoning.

AN ENGINEER WILL DO LESS CREATIVE ENGINEERING WHEN HIS MANAGEMENT RESPONSIBILITIES INCREASE.

Engineers sometimes rationalize their bent for things and their familiarity with traditional logic by taking positions such as these: [2]

¶ Engineers are different and therefore deserve special treatment. Their minds work differently from individuals who have not been disciplined under engineering training. Business managers as a group just basically do not appreciate the engineer's contribution to problem solving.

¶ Management does not understand or respond readily enough to engineering logic, nor does management itself use logic very well. Management, therefore, is inclined to be sloppy in approaching what seem to be straightforward problems.

¶ Engineers are too busy to be gregarious except as they may enjoy the companionship of other engineers. They have more important things to do than idly pass their time with persons who think less precisely.

¶ Management is not truly professional when it compromises logic for personal, political, or other unscientific reasons, and such action is beneath the ethical standards of an engineer. The engineer should never be expected to be so haphazard in his decision making.

Although portions of these contentions may be well founded, it is equally true that businessmen will not buy all of these allegations. But I believe the engineer's position in this matter can be understood if we review the characteristics of his educational background.

The Engineer's Education. Professional engineering education places strong emphasis on the objective approach. This approach is based upon the orderly fundamentals of mathematics, chemistry, and physics. After two or three years of such foundation subjects, engineers tend to build on these cornerstones by specializing further in some field of design or application. The Mechanicals may become concerned with kinematics or thermodynamics; the Civils with highways, sewers, or dams; the Electricals with circuits, electron behavior, or power transmission; the Chemicals with combinations of elements and processes.

With this kind of training as the background, it seems only natural that engineers should emerge as graduates having logic as their long suit.[3] This is the mathematical, engineering type logic—the

this is "life insurance" for boilers

It's a good "policy" to protect your valuable boilers with YARWAY Boiler Level Indicators.

Instant . . . accurate . . . continuous remote readings of boiler water levels are available on the instrument panel or wherever you wish in the plant.

YARWAY's new "wide vision" face gives brilliant readings from any angle . . . and the pointer is always visible, even at extreme high and low water levels.

For brilliant "shines like a star" readings on the boiler drum you'll want to use YARWAY Flat Glass Gages with Type "M" Illuminators.

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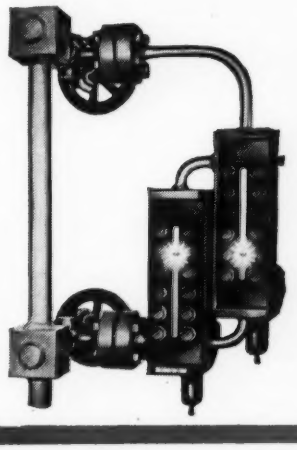

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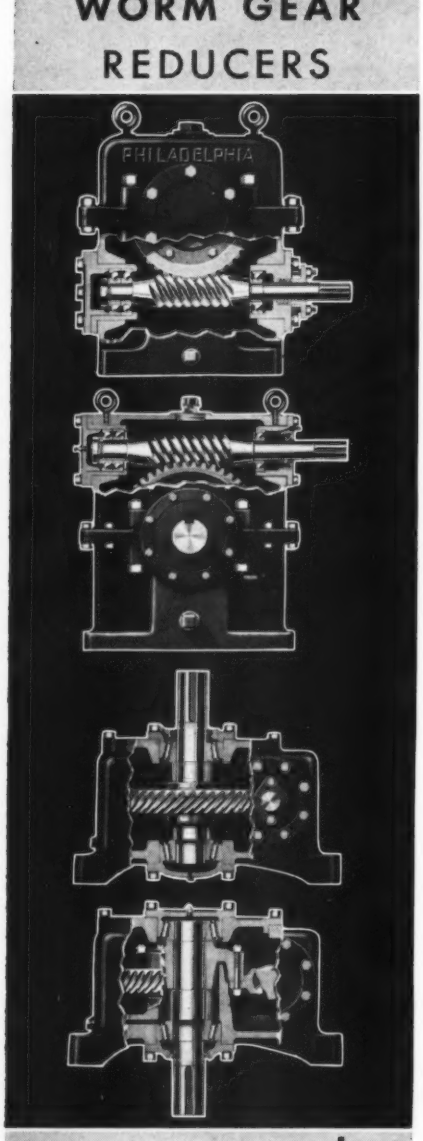

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key to analyzing measurable, orderly phenomena. Subject matter that may be required in economics, social sciences, or in the arts often is approached with impatience, disgust, or distrust.

The Engineer's Work. After several years of scientific training, the youthful engineer emerges to take a job—a job as a trainee, or a junior engineer—but still, as an engineer. This job can involve a couple of years on the drawing board, with a field crew, or as an inside engineer.

Having demonstrated his ability to think, the budding engineer frequently receives a promotion. At this point he is still concerned primarily with technical work; with the solving of engineering problems but not with the reactions of people.

As the engineer works his way up the ladder, his next position is likely to be that of senior engineer. Here, he may work with a small engineering group, perhaps checking the results of the group's activities. But generally, this position will not be one with over-all administrative responsibility. He is still dealing with "things."

Then, our man may emerge as a manager. He may not have much to manage, but he will be a manager nevertheless. It is here that he must try to get others to work effectively for him and with him; for the first time he must deal with the heavily loaded problems of people. A great many good men are lost on this frontier.

The Job of an Engineering Manager

But what is the management side of this business coin? What is required of a successful manager? Consider for a moment a few new requisites, that transcend the young engineer's formal education and early experience with engineering problems. He must work easily and confidently with his client's executives and with contractors and architects. He must assume broader administrative responsibilities within his own firm; meet and speak with businessmen on matters of general interest.

These management responsibilities call for the ability to carry on client development work, to inspire client confidence, to negotiate favorable working arrangements with contractors and architects and to understand thoroughly the cost-profit implications of the firm's and the client's activities. Internally, broader administrative responsibilities open new vistas concerning the incentives that inspire men to work, the training of men, and their compensation. Providing for adequate communication of thoughts and ideas, for effective office procedures, and for satisfactory measures of the firm's performance also challenge an engineering manager. In addition, he must create a favorable reaction in the mind of the general business public if his firm is to be widely known and well received. Certainly all these call for knowledge and skill beyond the ability to design inanimate objects.

Successful managership actually requires the understanding of another kind of logic—the "logical" actions of people—client personnel, staff members, the public in general. In recent years, exploration of the subject has suggested that understanding human motivation may be as important as a knowledge of traditional logic.

While the graduate engineer can think, he often has a difficult time getting his message over to others. He seldom appreciates the fact that others do not think as he does. But in a management sense, how can an engineer be effective unless he is capable of transmitting his thoughts clearly to other people and unless he can successfully understand the motives of those with whom he must work? This question points up the major gap that must be bridged between the job of a staff engineer and that of a manager.

Making the Transition

The engineer who wishes to make this transition must be interested in managing. Many are not. But engineers should recognize that more business failures are due to a lack of administrative talent than are caused by lack of technical ability. Compensation scales reflect this fact.

With keen interest and a desire to manage, the staff engineer then should recognize the need for new

skills in which he may have had little prior training. He must be willing to seek this knowledge and to gain experience, which, as in any field, paves the path to success. Having satisfied these two underlying requisites, the engineer should launch his own personal program for advancement. But his firm and his supervisor can contribute to his success.

The Firm's Role

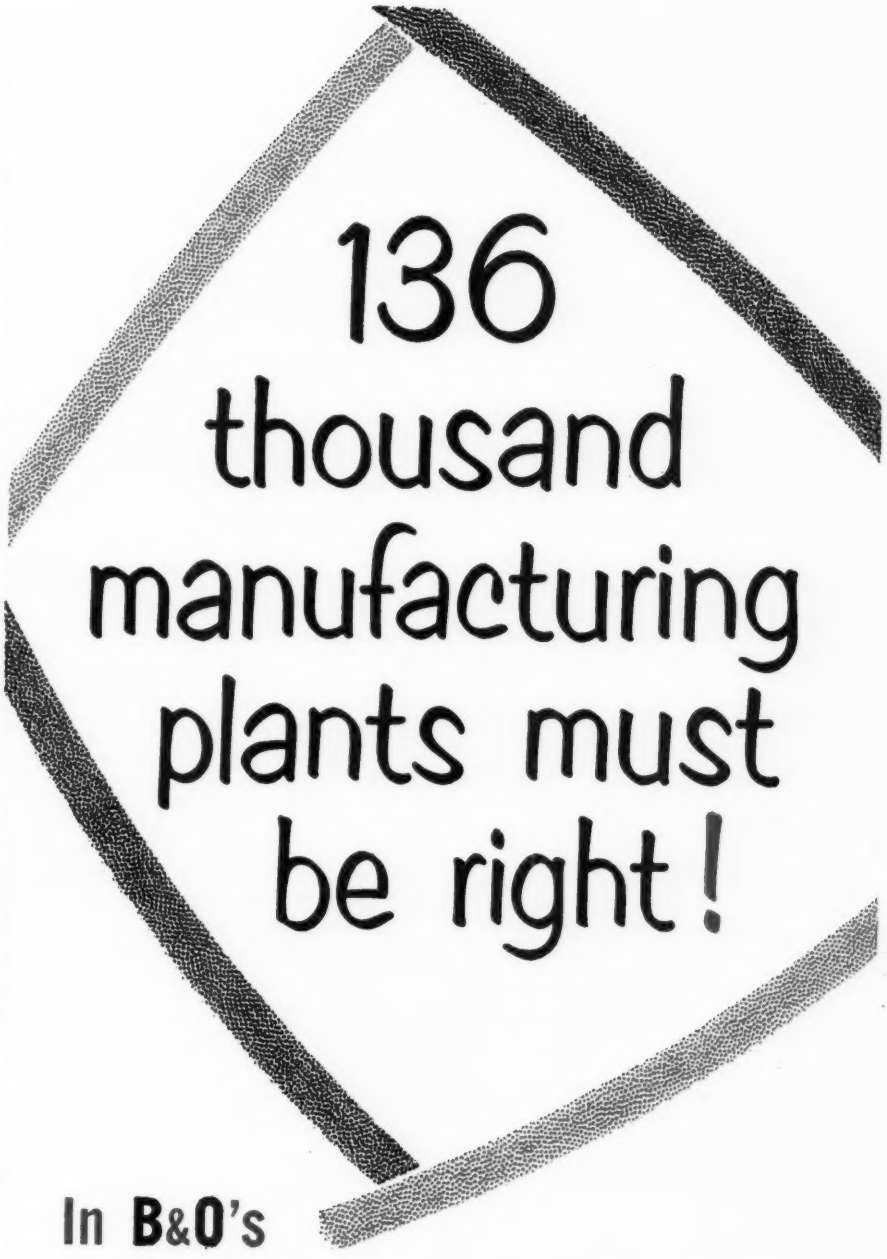
Consulting engineering firms should provide a favorable climate for developing their staff engineers into future managers. This climate is created at the firm's executive level. It stems from an appreciation of need for sustaining strong management.

Beyond this, any management development program must have two important characteristics: it must be practical, and it must be suited to the particular needs of the organization. A successful program does not require a large staff; neither does it need unusual publicity. In fact, recent studies indicate that highly procedural-ized, formal programs may actually defeat their very objective.[4] But regardless of the details, any successful program will have these common characteristics.

Objectives and Policies. Each organization has goals and plans for achieving objectives. These objectives and major policies should be well thought out and reduced to writing so that all staff members can have clear-cut direction in their daily activities. A better understanding of these guidelines for organized effort also can be achieved in informal group discussions. In this way, orient potential managers to the firm's broader viewpoint.

Position Descriptions. Spell out the general duties and responsibilities of each type of staff position. When men clearly understand what is expected of them and the extent of their authority, they are free to go ahead; to grow; to demonstrate good performance. They can act without fear of conflict with others. By eliminating confusion, it is less likely that initiative will be frustrated.

Training Guides. Describe philosophy, techniques, and approach-



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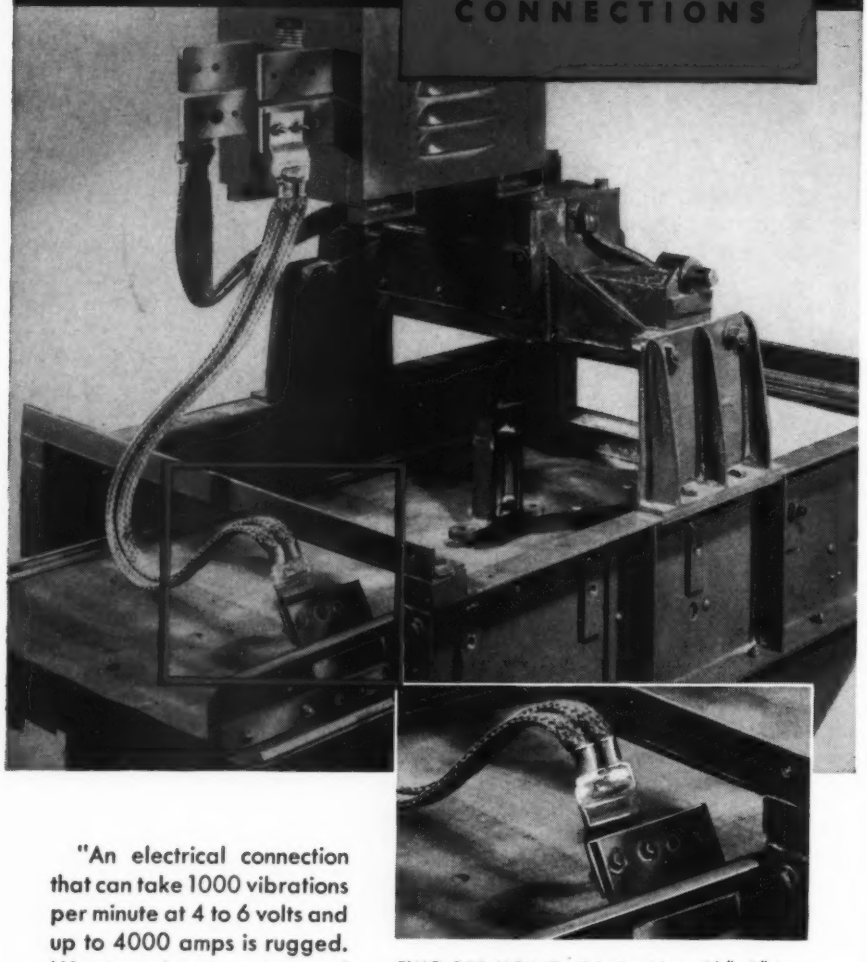

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es that the firm has used successfully to build its reputation for working well with clients. In this way, valuable experience can be passed from executives to their staff engineers. Such information not only helps the staff man in his daily work; it also broadens the engineer's outlook and directs his thinking along management lines.

Group Discussions. Openly discuss such problems as the firm's approach to its work, how to improve client relationships, matters of internal communication, procedures, and policies in small informal gatherings of engineers. Well-planned discussions of this type encourage the trading of experiences and provide opportunities for analyzing aspects of firm activity beyond the daily routines.

Schooling Programs. Urge engineers to seek a broader base of general business knowledge. Formalized schooling may be organized either within the firm or made available on the outside. Local colleges, university extensions, or night schools offer practical courses in accounting, business law, economics, production, and other business management subjects. These can widen an engineer's scope and viewpoint.

The Supervisor's Role

Firm-sponsored programs can be worthless without the enthusiastic participation of top executives and down-the-line supervisors. But even without an effective company program, the staff engineer's immediate supervisor can contribute importantly to his development as a manager.

One of the reasons why the supervisor's job is difficult is that his subordinates often are untrained. Therefore, time spent helping them will return him dividends. There are few quicker ways to grow in an organization and to reap the benefits of promotion than by "pushing yourself out of your own job." A supervisor can take the following steps in helping his men to develop. Though this may seem elementary, it is astonishing how frequently these fundamentals of supervision are overlooked.

Define the Job. It is important that subordinates have a clear un-

derstanding of what is expected of them on each assignment. No man can give his best performance when he does not understand his part of a team effort. Reducing instructions to writing often helps both superior and subordinate.

Improve Delegation. Since every supervisor must get things done through other people, delegation is an essential in any supervisor's job. One of the prime complaints of subordinates today is that their supervisors do not delegate sufficiently. When they do, frequently too much control is retained by the supervisor. Often the delegator will go into detail of how the job is to be done as well as what is to be done.

Direct Decisively. Another great complaint of many subordinates is indecision among those in charge—the failure of superiors to face up to the need for decision. Actually, there are many times when inferior decisions are better than none at all. A number of prominent executives have been quoted as saying, "You need to be right only 51 percent of the time." The effective executive does not keep his subordinates "up in the air." He makes his decisions promptly, or tells his subordinates why he cannot decide now and when they can expect a decision.

Base Decisions on Fact. Unless the approach to decision-making is fact founded, subordinates necessarily must try to guess the emotional attitudes and experienced biases of their superiors. Other good reasons why decisions should be based on fact are: it is easier to make a decision on the basis of fact than on hunch or personal opinion; decisions based on fact are much more likely to be good ones; and decisions based on fact are much more defensible. As industry becomes more complex, the need for the factual approach will get greater emphasis. This provides a natural opportunity for the engineer-manager, for the engineer naturally prefers to deal with facts.

Be Open-Minded. This is one of the best ways to encourage subordinates to bring in ideas. It helps them grow; it increases the possibility that worth-while ideas will come to the attention of management. Good practice indicates that a new idea be greeted with at least a "maybe" rather than an outright "no." Periodic agreement with a new idea, even though the idea may not be great, also is helpful.

Understand. An essential ingredient in developing men is to be able to understand the other fellow's viewpoint. Understanding can only be developed with patience and a great deal of tolerance. A good executive knows that he must build on the strong points in his men. He will respect the contribution that each can make to a total team effort.

Keep a Good Balance. Coupled with energy, enthusiasm, and drive, a good sense of humor and a high degree of emotional stability are important assets to the manager and to the would-be manager. The greater the executive, the less likely he is to take himself too seriously. That does not mean that he is not serious, but that he has a lightness of touch and an informality of manner that seem to have their origin in a sense of humor. The asset is sometimes termed a "pleasant change-of-pace."

While emotional stability is hard to describe, it has become a useful label for the degree of maturity and solidarity of emotions in a man's personal make-up that keep him from going to pieces under pressure. The emotionally stable person does not get unduly upset when the going is rough, and there are many important things to do at the same time. Keeping a good balance has an important effect on the morale of subordinates.

The Individual's Role

The staff engineer himself holds the master key to his management doorway. The staff engineer must supplement aids provided by his firm and personally plan a program for development. He can do this even if no firm-sponsored program is offered; even if his superior is not particularly helpful.

Every engineer who aspires to management can speed his progression by realizing that as he becomes increasingly successful

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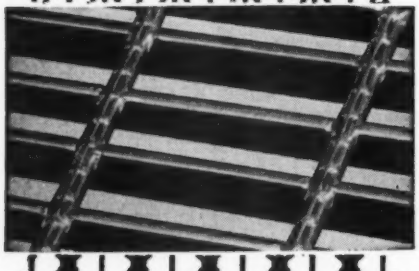

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as a manager, he will be doing much less creative engineering. He must be satisfied with this inevitability, realizing that there is a definite choice involved. He may prefer to remain an engineer.

It is also necessary for him to get the most out of his job day-by-day. This can be done by:

¶ Undertaking special work assignments, particularly those bringing him into working contact with supervisors or others in management positions.

¶ Participating in problem solving conferences, which will allow him to share in decision making.

¶ Assuming more responsibility, by accepting the delegation of adtional duties, or requesting them from his superior.

He should seek the acquaintance of others outside the field of engineering. Through these avenues an engineer may broaden his business interests, learn of problems that concern others in their work outside the engineering field, and in general gain a better appreciation of over-all problems of business management. Success in this step will begin to manifest itself by an awakening appreciation of the many facets and activities (only one of which is engineering) that must be coordinated to the total profitability of any enterprise.

Reading business periodicals and studying those texts on business management that emphasize the coordination of various activities required of any manager will aid the staff engineer's progression. Of even greater significance are those business writings[5,6] that explore the means for understanding human motivation.

The staff engineer should attend society or professional group meetings to broaden his knowledge of business problems and to meet with others. Taking official responsibilities in such organizations will provide a measure of administrative experience.

He also must be willing to modify his personality to the extent necessary to get along comfortably with other people. Often the pure engineering stigma impedes an engineer's acceptance into a top management situation. Certainly, aloofness is a hindrance.

Another factor should not be overlooked. The staff engineer can help himself by being alert to opportunities to demonstrate ability to manage or to show appreciation and tolerance for the importance of functions (other than engineering) involved in running a successful business.

Night school or other courses in such business management subjects as accounting and controllership functions, labor relations, production techniques, and the like are extremely beneficial. These will help to speed the transition to any management job. Public speaking courses also have proved valuable confidence-builders for many engineers.

Finally, he should develop an ability to sort out the important from the unimportant. American business is comprised of too many managers who allow themselves to become burdened with trival detail. Unfortunately, many do not recognize this fact. They have been dealing with the unimportant so long that they have lost their ability to differentiate. It is not possible to manage well if ability to distinguish the important considerations from the unimportant is lacking.

For the staff engineer with a management goal and the desire and drive to attain it, the rewards are many. In exchange for his time and effort, the engineer can look forward to increased financial satisfaction. He can find internal satisfaction, too, in an improved status within his organization, and his community. ▲▲

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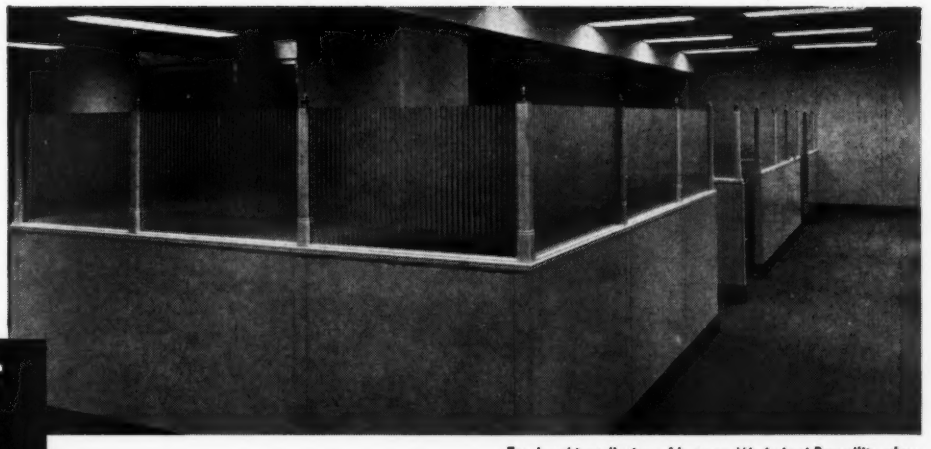

Eye level installation of lustrous Mississippi Broadlite glass.

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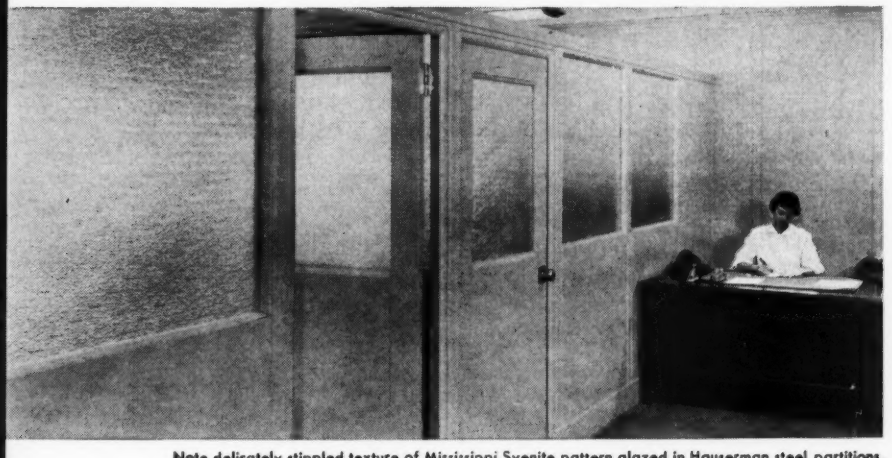

Note delicately stippled texture of Mississippi Syenite pattern glazed in Hauserman steel partitions.

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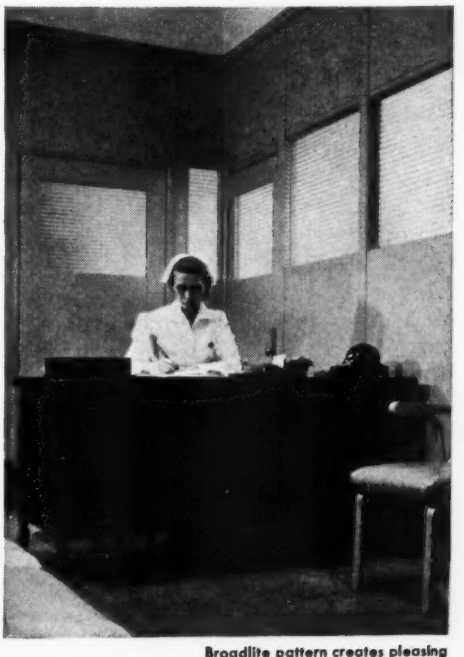
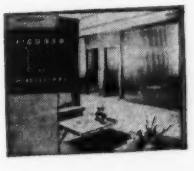


Broadlite pattern creates pleasing straightline effect in modern interior.



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National Federation Steering Committee Meets

The interim steering committee for drafting a constitution for the proposed National Federation of Consulting Engineers met in the Blackstone Hotel in Chicago, February 11-12. John K. M. Pryke of the New York Association is chairman of this group. Thomas E. Roche of the Minnesota Association is secretary. The other two members of the committee are Pecos Calahan of the California Association and B. M. Dornblatt of the Gulf Institute.

This committee agreed upon a draft for the constitution and bylaws, and copies of this proposed form will be sent to all members of all associations of consulting engineers within the next thirty days. It is expected that the ten founder associations will be able to indicate their proposed amendments to this constitution and bylaws within about ninety days and that this will be followed by an organization meeting in Oklahoma City, probably in July.

Bridge Design Advanced By Improved Welding Techniques

With the change from through-type to deck-type bridges, welded design has gained in popularity. Since 1942, the Department of Public Works of the State of New York has designed and constructed approximately 800 steel bridges, all of which, with a few exceptions, have been welded. Most of the 500 bridges on the New York State Thruway are welded. An all-welded steel railroad bridge, designed by the Department, has been in use since December, 1954.

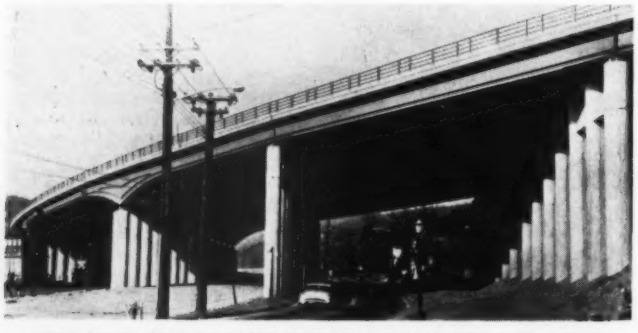
The welded design provides for efficient and economical use of materials, since the full section of steel members can be used without allowing for reductions necessary with riveted structures. In many instances, especially where continuous design is used, the overall depth of the bridge deck can be reduced significantly, providing necessary headroom under the bridge while permitting a saving in materials and in bridge approach fill.

Savings on welded steel bridges designed by the Department have averaged 15 to 20 percent in steel and in total cost over comparable riveted structures.

E. J. Ramer and S. Miller, Principal Civil Engineers for the Department, have been directly responsible for the welded bridge designs.

Another development in bridge construction is the use of end welded studs as shear connectors in composite steel and concrete bridges. The first bridge incorporating these studs (over the Bad River at Fort Pierre, S.D.) is a continuous girder structure of five girders with shear connectors used in the positive moment sections of each girder. Sections are approximately 68 ft long for both end spans and interior spans. Although steel angles were originally specified as shear connectors, studs were substituted since they permit concrete to be compacted more satisfactorily and eliminate distortion and warping caused by hand welding.

According to K. R. Scurr, of the South Dakota Department of Highways, designer of the bridge,



TWO NEW YORK STATE THRUWAY BRIDGES OVER ERIE RAILROAD AND STATE HIGHWAY 59 IN SUFFERN, ROCKLAND COUNTY, ARE OF ALL-WELDED DESIGN.

STUD SHEAR CONNECTORS WERE END WELDED TO THE GIRDER FLANGES AT THE FABRICATING SHOP AND THE GIRDERS THEN TRUCKED TO THE JOB SITE.

WESTINGHOUSE SAVES $18,043 with USS "T-1" STEEL

The Sunnyvale, California plant of Westinghouse Electric Corporation controls vibration of huge wind-tunnel air compressors with unusual supporting struts. Steel bellows that flex, both up-and-down and sideways, absorb and isolate the tremendous vibration in these powerful machines. Westinghouse lopped an impressive $18,043 off the cost of these bellows by switching to USS "T-1" Steel.

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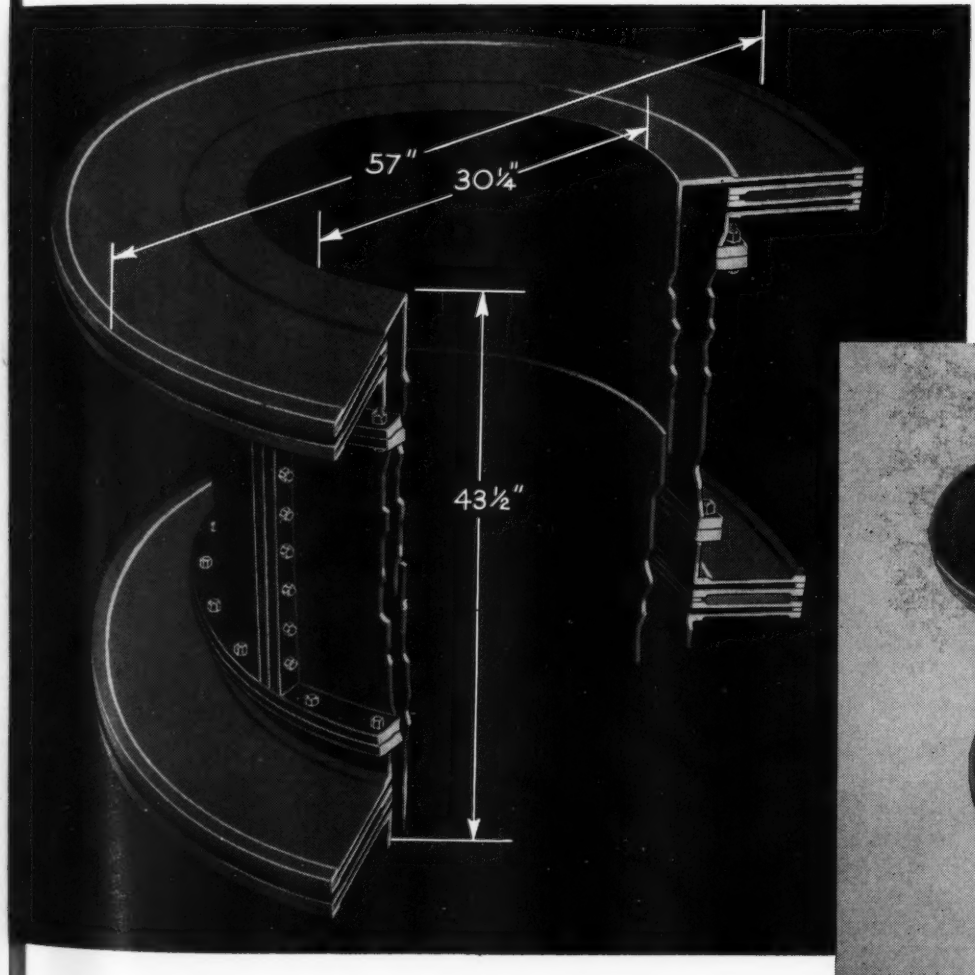
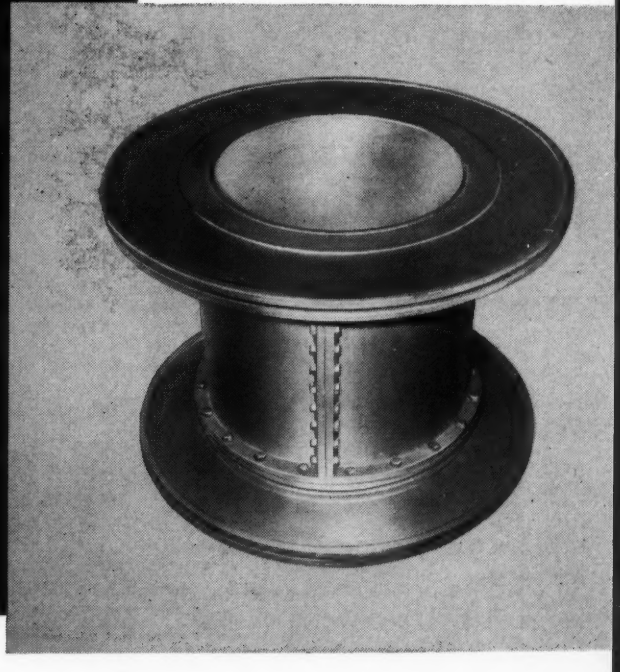


STEEL BELLOWS SOAK UP VIBRATION. Here is one of the struts that support each air compressor. Two steel bellows—at the top and at the bottom of the central cylindrical section—flex and absorb the shock and stress of heavy vibration from the compressor. Tough, strong, steel was needed for the bellows. USS "T-1" does the job, and saves money for Westinghouse Electric Corporation.



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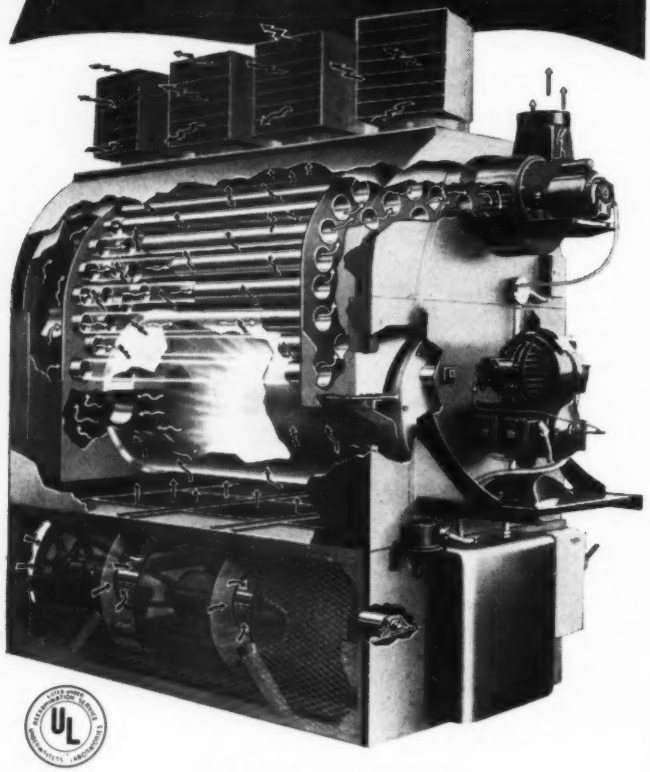

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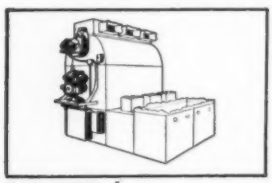
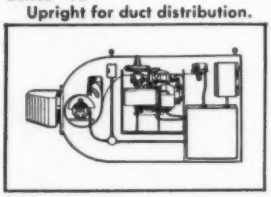
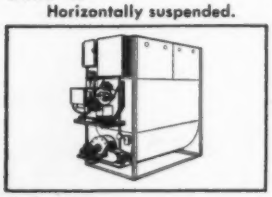


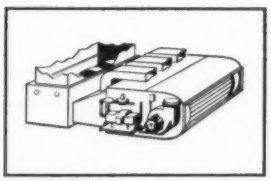
Series "FD"
Upright for duct distribution.



Series "H"
Horizontally suspended.



Series "U"
Inverted suspended.



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the studs permit a clean design with flexibility in placement, since studs may be spaced wherever required, with little concern for the location of transverse slab reinforcement. The contractor used the studs as an aid in spacing mat for reinforcing bars. Spacer bars were tack welded to the studs and the mat fabricated in place. The Nelson studs used on this job are now shown in specifications as alternates for bridge design in 22 states where composite bridges are used.

Seelye, Stevenson, Value and Knecht, of New York, were consultants on the South Dakota job.

High Velocity Air Conditioning Designed for Hospital

Air conditioning an existing structure such as a hospital involves consideration of cost, possible tie-in with the present heating system, and the least disruption to use of the building. For St. Joseph's five-story maternity hospital in Houston, Texas, four different air conditioning systems were considered by the consulting engineers, Bernard Johnson & Associates: conventional duct system; perimeter fan and coil system (chilled water piped to individual units in each room); high velocity double duct system; and high velocity single duct system.

The conventional duct system was ruled out on the basis of inconvenience to the hospital staff, since the large openings necessary would mean extensive cutting through walls. The building structure was such that perimeter fan and coil cooling would be unduly expensive. The final choice was the single duct high velocity system, since the building had an existing radiation heating system that was in excellent condition. The smaller ducts used in this system could be threaded through the beams, columns,

MONORAIL TEST LINE ERECTED

Towers to support the 970-ft Monorail pilot test line in Arrowhead Park, Houston, Texas, are shown under construction. The line went into operation in February. Consulting engineers on the project are Francis A. Niven and Col. Sidney H. Bingham, recently retired executive director and general manager of the New York Transit Authority. Weldon F. Appelt, of Clear Span Engineering Co., is the design engineer.

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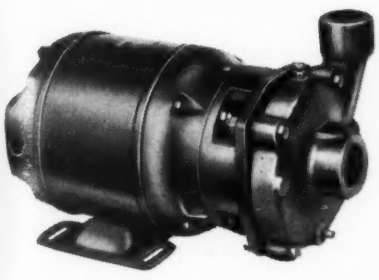
And it's this same knowledge incorporated into WEINMAN PUMP design and manufacture, that makes a WEINMAN PUMP so superior in dependability, efficiency and economy! The years of experience and "know-how" accumulated in the field, by WEINMAN Pump Specialists, are built into every WEINMAN PUMP! That's why, from Impeller to Shaft Seal, a WEINMAN PUMP is the *best* pump for your job!



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and joists of existing structure. Trunk ducts are 26 in. in diameter and feeder ducts only about 10 in.

The primary problem on this project was use of a recirculating air system in a hospital, where objectionable odors are created. The odor problem was solved by the application of activated carbon air filters in series with glass fiber blanket filters and electrostatic filters to insure delivery of pure air.

Three central built-up air handling units in the basement serve the high velocity room units. These units, plus four central conventional air handling units, are served with chilled water provided by two, 100-ton packaged water chilling units and plant steam. The water chilling units, chilled water pumps, and condenser water pumps are also located in the basement. The induced draft cooling tower serving the water chilling units is located on the laundry roof. Capacities of the three central built-up units are 14,350, 25,875, 17,500 cfm, each unit supplying conditioned air to a particular zone. Air-conditioning in each 4-bed, 2-bed, and private room can be controlled individually by the patient or the nurse.

The installation was planned so that only one-half of the maternity hospital had to be closed at a time.

A by-product advantage of the new system is the addition of acoustical plaster to the new ceilings. This greatly reduces the noise transmission in the rooms and corridors. ▲▲

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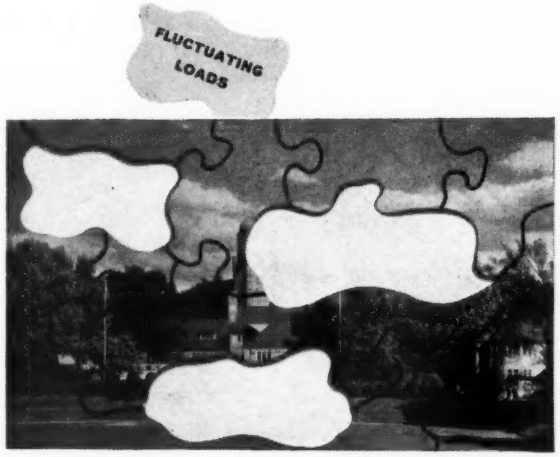


HOW A JIGSAW HEATING PUZZLE WAS SOLVED

KEWANEE reserve plus rated boilers

MET SCHOOL HEATING NEEDS

A jigsaw puzzle heating problem . . . that's what it looked like at the Cranbrook School for Boys, Bloomfield Hills, Michigan, since the heating needs were so varied. But every puzzle piece fell into place when Kewanee Reserve Plus Rated Boilers were installed, because all heating needs were solved. Here's the way it worked:

Problem 1: Limited boiler room.

Solution: Two compact Kewanee Scotch Type Boilers with 50% reserve power guaranteed adequate heat under all conditions.

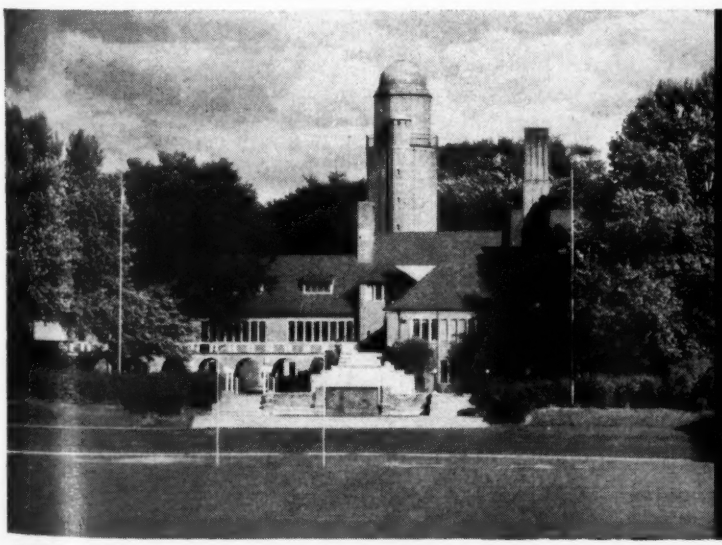
Problem 2: Fluctuating loads—boiler turned off nightly, turned on by stages in the morning.

Solution: Kewanee Boilers had sufficient reserve to assure a fast, dry steam when needed to give quick heat.

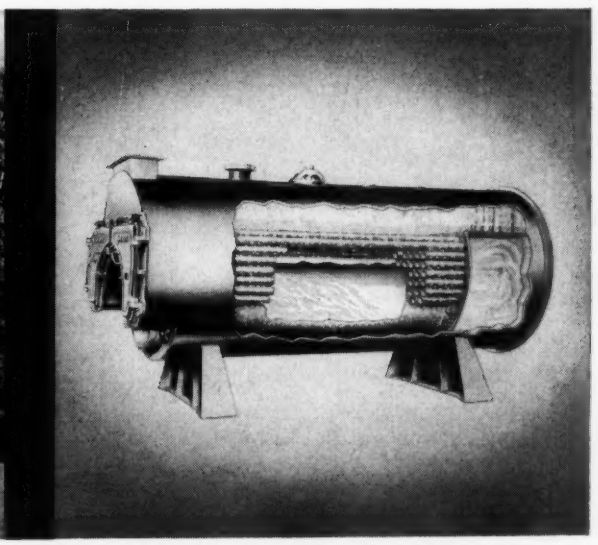
Problem 3: Low operating—maintenance costs.

Solution: Since Kewanee Reserve Plus Rated Boilers certify 50% extra power built in, they operate at "cruising speed." Result—less fuel used, less wear on boiler, greater efficiency delivered.

Kewanee Reserve Plus means boilers are rated on nominal capacity, with adequate power to take care of present needs, emergencies and future expansion. Boilers rated on maximum capacity are inadequate for today's fast growing school needs. Next time select Kewanee Boilers.



Cranbrook School for Boys, Bloomfield Hills, Michigan
Heating Contractor: Laing Plumbing & Heating Company, Pontiac, Michigan
Engineer: Snyder & McLean, Detroit, Michigan



Kewanee LM-800 Series for 15 lbs. steam or 30 lbs. water installed in the Cranbrook School for Boys.

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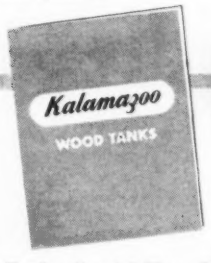

2

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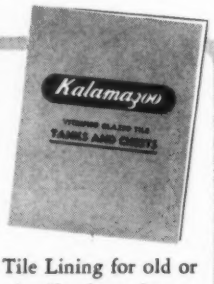
3



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Report From South Africa

PETER HOLZ

CE exclusive

THE UNION OF SOUTH Africa is today, and indeed has been for quite a number of years, the workshop of Africa. Of the whole continent's white population of approximately five million, two million live within the 472,500 square miles of the Union.

Half of these two million whites live in Johannesburg and the string of satellite towns on either side of it. It is in Johannesburg, second largest city of Africa, and these adjoining towns, collectively called the Witwatersrand, that the major part of the country's industry is situated. The development of industry in this area is dependent, and no doubt will remain dependent in the foreseeable future, on the country's gigantic mining industry.

Gold, diamonds, platinum, uranium, coal, copper, asbestos, manganese, and many other base and precious materials are mined here. The gold mining industry alone offers employment to 350,000 people, most of them unskilled or semi-skilled Africans. The value of exported gold amounts to something like $480 million per year, and there are few industries in the Johannesburg area that are not directly or indirectly dependent on it.

Most of the mines, diamond, gold, or coal, belong to big mining groups, such as the Anglo American Corporation. Everyone of these mining groups maintains its own engineering staff consisting of qualified mechanical, structural, and civil engineers as well as a multitude of draftsmen and metallurgists. There is thus little work for the consulting engineer in private practice as far as the mining industry is concerned. Yet in Johannesburg, alone, there are about fifty such consulting engineers, while there are many more in the other large centers such as Durban, Port Elizabeth, Cape Town, and Pretoria.

Most of the South African consultants are engaged in civil engineering work. Many belong to world wide engineering associations, such as the American Society of Civil Engineers, as well as to purely local institutions. They tender on government projects such as dam construction, ambitious irrigation schemes, and every conceivable type of reinforced concrete construction. Quite a few of the existing consulting firms have commitments in neighboring, less industrially developed territories such as South West Africa, the Central African Federation, Portuguese East and West Africa, Swaziland, and Basutoland.

Central Africa Industry

Industry in these territories, particularly in the new Central African Federation, comprising Southern and Northern Rhodesia and Nyasaland, is growing as fast as it is in the Union. Development on an unprecedented scale is taking place all over Southern Africa, and there seems to be plenty of work for all for many years to come. As one great scheme is completed another is commenced, and the engineer who knows his job is always sought after. It is unfortunate indeed that both the skilled engineer and the unskilled African are grossly underpaid. Engineers, draftsmen, architects, and metallurgists who have spent many years and large amounts of money on their technical education, find their salaries quite inadequate. This factor has contributed to quite a large extent to the almost dangerous shortage now existing, and the newspapers as well as the technical press are forever filled with situations vacant ads. Here, however, as in other parts of the world, the suc-

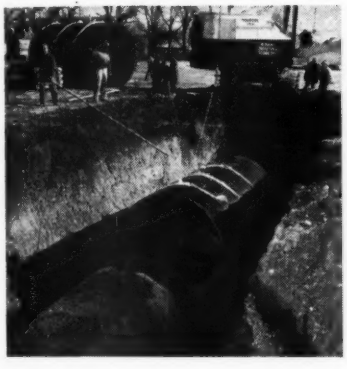
Top structural strength

Top material durability

Top flow capacity

Only with an Armco Sewer can you get all 3

Armco Corrugated Metal Sewers offer advantages unmatched by any other type of sewer structure. Want proof? Check the following four statements. **Only** an Armco Sewer gives you the choice of all these advantages in a single structure. And you can specify the strength and durability **required** by your application.



- ☐ **Flexible corrugated metal strength to withstand the impact of live loads without cracking or breaking.**
- ☐ **Choice of coatings to meet corrosive conditions, plus a thick pavement to combat erosion if required.**
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- ☐ **Strong, quickly-applied joints that eliminate possibility of disjointing, infiltration or failure as an integral conduit.**

Strength? Armco Structures are used under fills as high as 165 feet. One, under a railroad in Wyoming, still has perfect alignment after 29 years under a 77-foot fill.

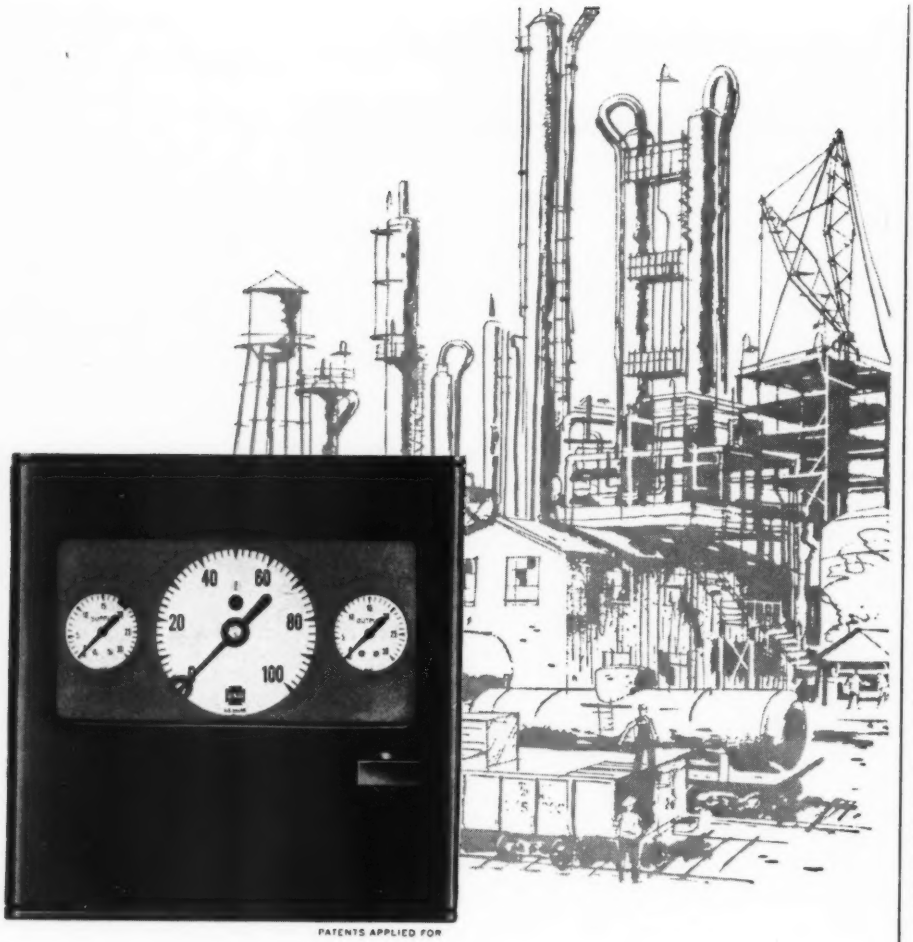
Material Durability? 49-year-old Armco Sewers are still giving good service today. And these have just a plain galvanized coating. Today's Armco ASBESTOS-BONDED Structures will assure a much longer life.

Top flow Capacity? Armco's new sewer product, SMOOTH-FLO Pipe, has a smooth spun asphalt lining covering all inside corrugations. There is nothing to impede flow, even on flat slopes.

For data, just write us and tell about your sewer problem. We'll also give you recommendations, if you wish. Armco Drainage & Metal Products, Inc., 4046 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO

Armco Sewer Structures



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cessful consultant does much better financially than the engineers employed in industry.

New Projects

Within the Union of South Africa, a large oil-from-coal plant has just been completed at an estimated cost of some $75 million. The American firm of M. W. Kellogg had a major hand in its construction which took almost four years from start to completion.

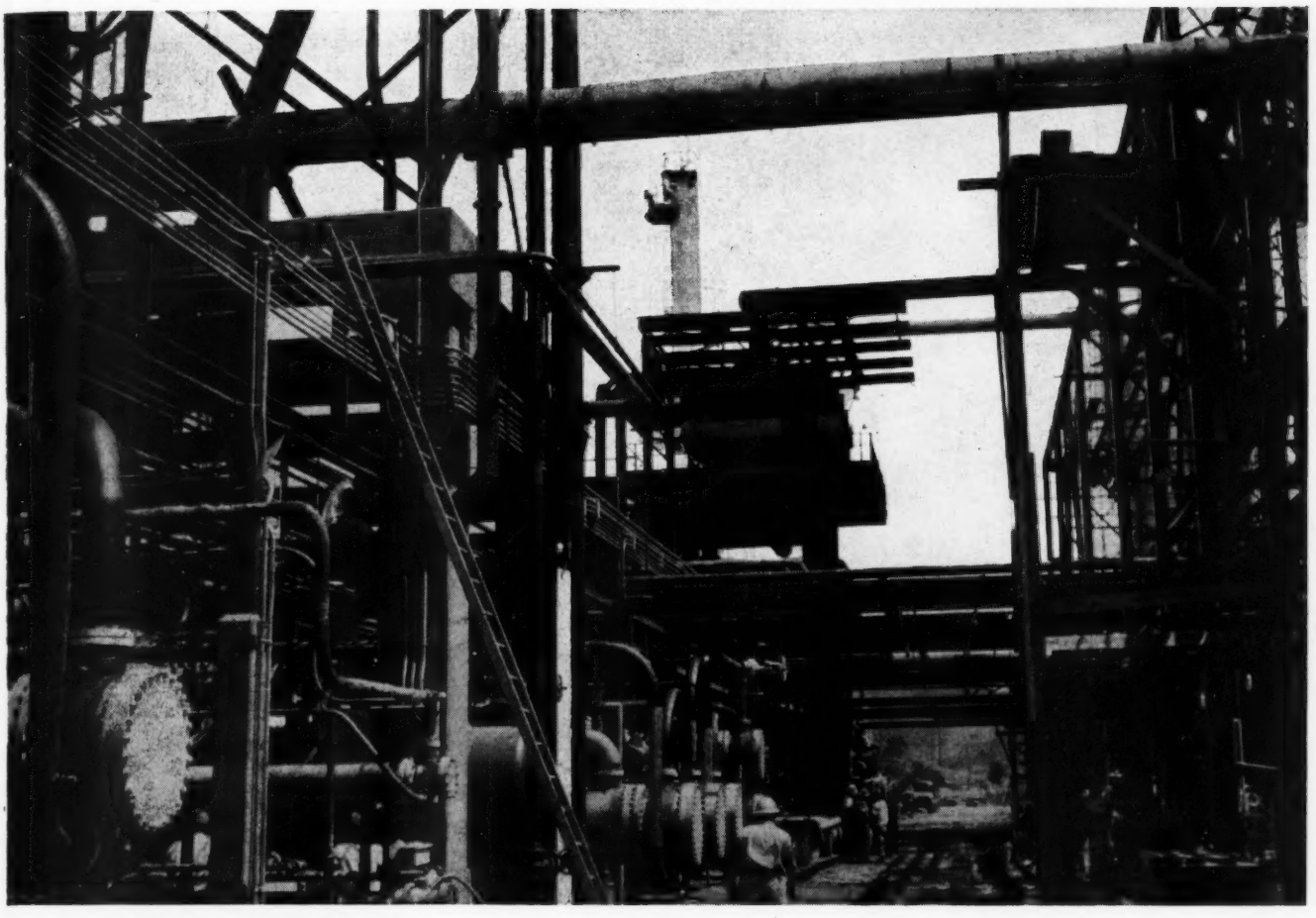
In the Orange Free State, one of the four provinces of the Union, one gold mine after another is being brought into operation. Quite a few of them have adjacent uranium plants, which extract this vital material from crushed rock from which the gold has already been removed. In these large and modern plants, designed and built by South Africans, the crushed waste rock is mixed with acid, then filtered. The solid residue is discarded while the solution is processed further. Uranium oxide is finally precipitated and is shipped to the United States and United Kingdom.

Most of the equipment for this new industry has been produced locally, and much resourcefulness has been shown in manufacturing unusual types of equipment never before made in this country.

In Natal, a $24,000,000 rayon factory has just been completed, and in the Cape Province, the great Wemmershoek Dam is making good progress. Thirty miles north of Johannesburg, in the beautiful capital city of Pretoria, the semi-governmental Council for Scientific and Industrial Research has just completed its cyclotron. Films of its opening have already been televised by the Columbia Broadcasting System in the U. S.

The cyclotron cost the country $1 million, but atomic-age conscious South Africans feel it is worth it. It is the first cyclotron in Africa and the third one in working condition in the Southern Hemisphere. One of this cyclotron's interesting features is its automatic, fully pneumatic loading and unloading system, which has aroused much comment among scientists abroad.

The country's steel industry,



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In 1955 Lummus designed and built all of the heat exchangers for Commonwealth Refining Company's complete new refinery at Ponce, Puerto Rico. Well over 100,000 sq. ft. of tube surface is represented in exchangers for the atmospheric and vacuum distillation unit, Houdriflow fractionation and vapor recovery sections, Houdriformer, sulfuric acid alkylation and acid regenerating units, and catalytic polymerization unit.

Before the original refinery was placed in operation, Lummus was requested to increase the refining capacity by approximately 150%. The new addition is scheduled for completion by the end of 1956. Repeat orders on Lummus designed equipment are frequent, because Lummus heat exchangers are engineered to meet customer requirements for long and trouble-free service.

The Lummus Company has now established a standard line of heat exchange equipment to meet the requirements of TEMA Class "R" and API-ASME code requirements. Write for your free copy of Bulletin MD-164 which completely describes this equipment.

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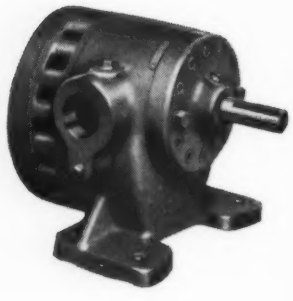

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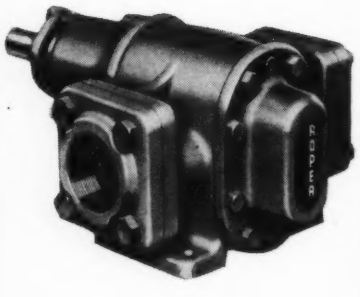
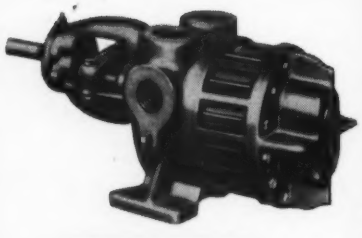
maintenance costs with a Roper. For instance, a pump like the Series H with pressures to 1000 P.S.I., sizes 10 to 75 G.P.M. is ideally suited for hydraulic mechanisms and for other applications requiring high pressures. Spur gears run in axial hydraulic balance . . . bearings and bronze wear plates reduce friction under heavy loads. Available with packed box or mechanical seal.

PUSH

the unit in your hydraulic circuit with the correct size Roper for the particular job. In many cases the Series K will do, for it is rated from pressures to 150 P.S.I., capacities ¾ to 50 G.P.M. This model is compact, sturdy . . . is self-lubricated by liquid pumped . . . handles total suction lifts up to 25 feet. Comes with packed box or mechanical seal . . . with or without relief valve.





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favorable comment on a wise choice when you install a Roper as original equipment. Among the dependable Ropers is the Series F Pump — pressures to 300 P.S.I., sizes 1 to 300 G.P.M. It features four-port design with 8 optional piping arrangements . . . supplied in standard or stainless steel fitted models. With packed box or mechanical seal; with or without relief valve.

particularly the Government controlled South African Iron and Steel Corporation, is expanding to meet the ever increasing steel demand of the country. The Corporation's production capacity is to be raised from 1.38 million tons per year to 1.8 million, and this will necessitate the expansion of the Corporation's iron ore mining activities. Much of the equipment required for this expansion will be made in South Africa.

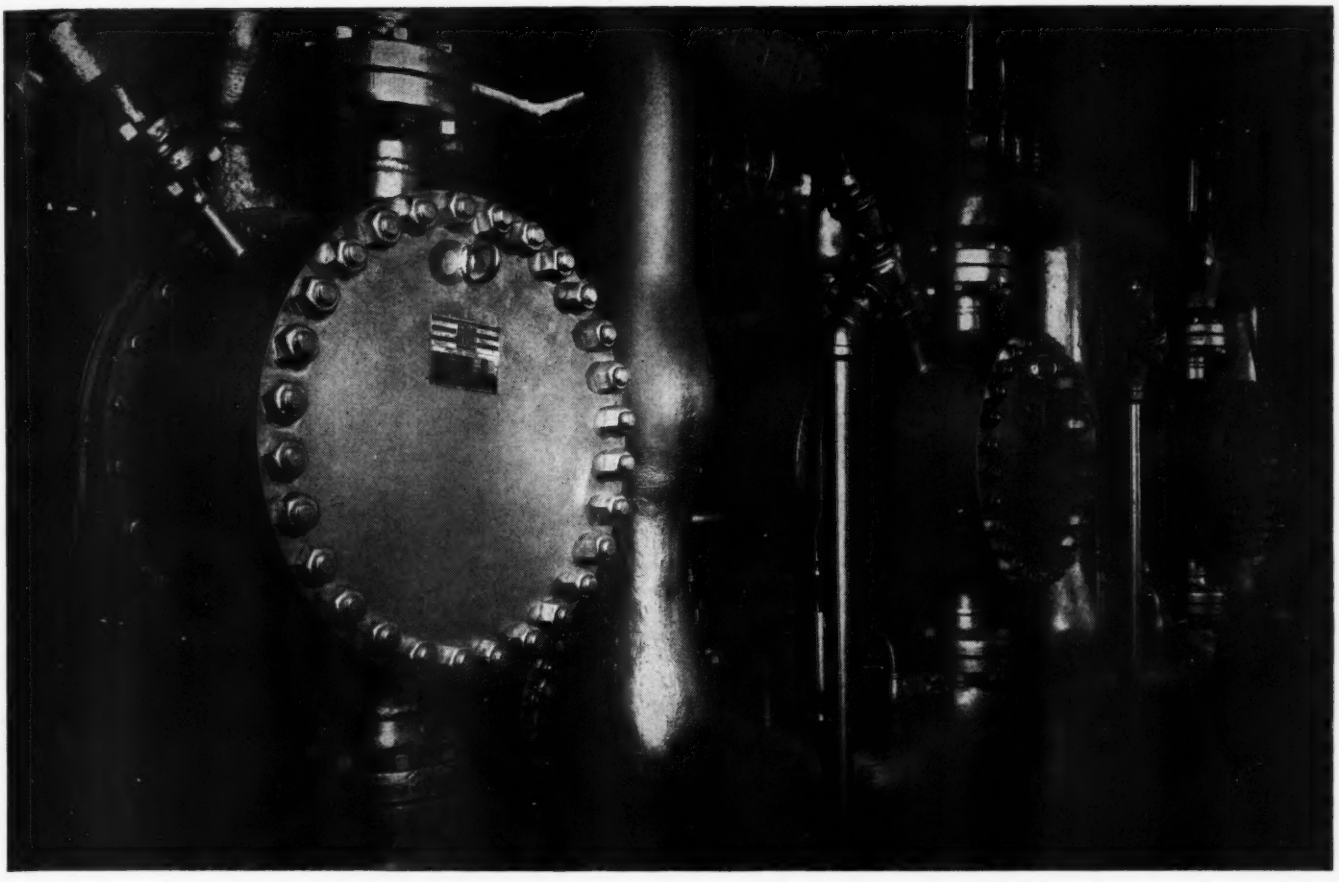
To the north of the Union, the Central African Federation has embarked on the building of the Kariba Gorge Dam, ultimately to be the world's largest. Originally the first stage of the huge hydroelectric scheme, designed to produce power by 1960 for the Rhodesian copper mines, was estimated to cost $160 million. This figure has now risen to $234 million without taking into account the possibility of raising the dam wall to four hundred feet. It was estimated that an increase in height of the dam wall could mean greater output of power at a lower cost.

The Kariba Hydroelectric power project will eventually have 16 generating units with a firm output of 1000 mw at a 74 percent load factor. Cost of power at receiving stations has been estimated to be in the region of about ½ cent per kwh.

Copper Mining

Copper is to the Central African Federation what gold is to the Union of South Africa. Every year about one quarter million tons of blister copper and almost as much of electrolytic copper are exported. Cobalt is produced as a by-product and is valued at about $6 million per annum.

Copper slimes are at present exported, and the selenium and precious metal content is extracted overseas. Other minerals mined in the Federation are lead and zinc, asbestos and chrome, gold and coal. At Que Que, iron and steel are produced from local supplies of iron ore, limestone, and dolomite, but not on the scale it is produced in the Union of South Africa. Once the mines are worked out it is anybody's guess what the industry will do. At present the life of many mines is rap-



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Simply stated, Ross designs and manufactures heat exchangers for virtually all conditions and applications, particularly units of a highly specialized nature, such as high pressure power plant equipment...bleeder heaters and fuel oil heaters, for example.

The installation of 6 Ross High Pressure Fuel Oil Heaters (illustrated) at the Pacific Gas and Electric Co.'s Station P Steam Plant in San Francisco is typical. Featuring forged oil channels with integral tube sheets and a double tube sheet arrangement to insure against any possibility of fuel oil contaminating the steam system, these rugged units demonstrate Ross' resourcefulness and experience in dealing with both the average and the specialized power engineering problem.

Your requirements, too, can be met with the same, exacting Ross attention to details. Inquire now. Ross offices are in all principal cities.

For recommendations on specialized heat exchangers, as well as on surface condensers, turbine oil coolers, engine oil and water coolers, compressor inter and after coolers and related power plant equipment, you'll profit by consulting a Ross engineer.

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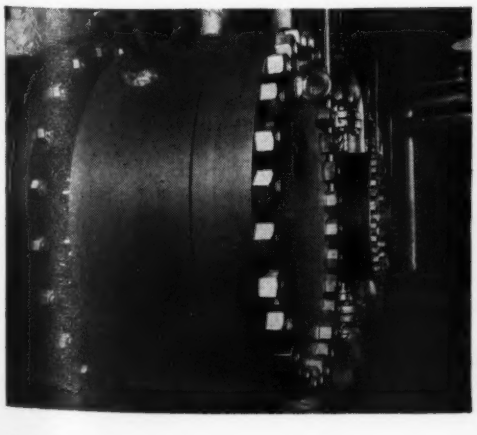

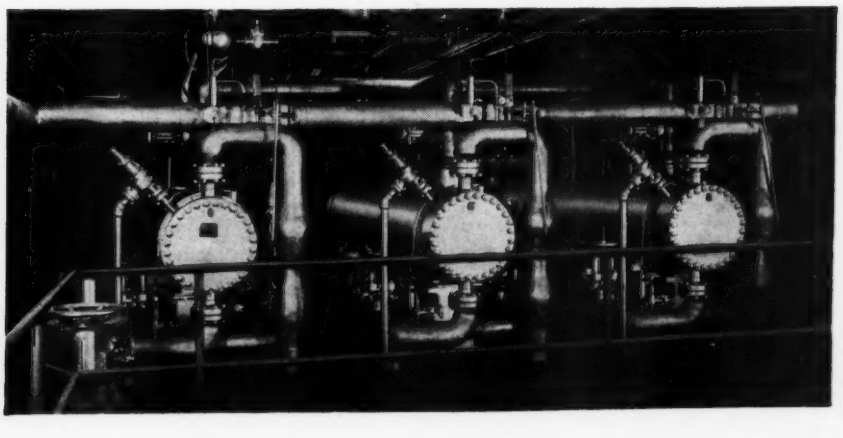

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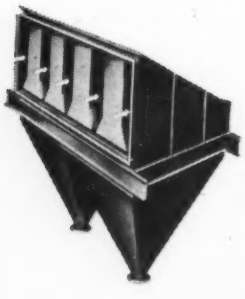
Whether the problem is industrial dust or flyash, you are assured of satisfaction with P-D Collector Systems, engineered to meet your specific needs.

Write for Reprint No. 102 titled, "What Type Collector?"



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idly coming to an end, but new mineral areas are constantly being discovered, so nobody is seriously worried just yet.

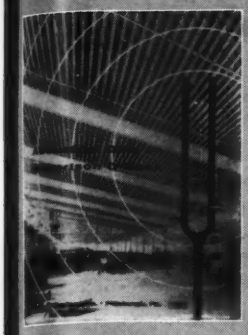
In the territories of Portuguese East and West Africa, in some parts still as wild and uncivilized as in the days of Stanley and Livingstone, South African consulting engineers are occasionally called upon to advise on bridges or small power stations. Because of a steel shortage, as much as possible is done in reinforced concrete. The Portuguese government clearly shows its concern in these two rather under developed colonies and is extremely anxious to develop projects connected with electrification, communications, and transport.

Railroads

The new Limpopo Railway between the Central African Federation and Portuguese East Africa was recently opened and has been heralded as a great engineering and economic achievement. Providing the Central African Federation with a direct outlet to the sea, it will also help in the development of areas that had to be neglected in the past.

In the Union too, the railways (government owned) are forever growing. Like the extensive mining industry, they have their own large staff of engineers and are, therefore, largely independent of outside firms. A group of their engineers is presently being sent overseas by the South African Railways to make a world study of diesel locomotives. Tenders for the purchase of diesel engines will be put out later in the year, and engines bought will be put into operation in the larger South African cities to improve smog conditions. No attempt will be made, however, to compete with electric traction, which is still regarded as the Union's most economical method of rail transportation. Steam locomotives will be seen less and less.

The vast industrial expansion in the last few years has by no means reached its peak. The countries of Southern Africa, in general, fear little of the future, which promises to be even more prosperous than the past. ▲▲



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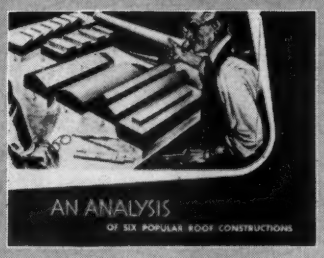

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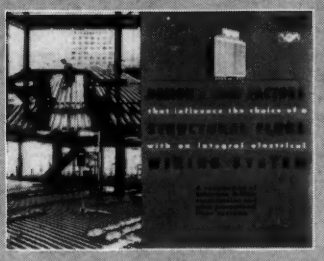

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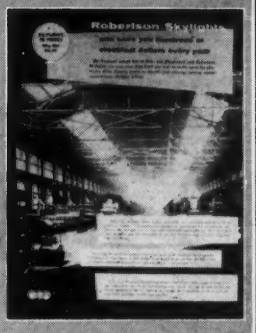

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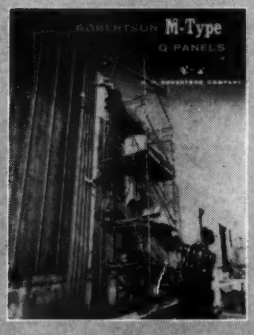

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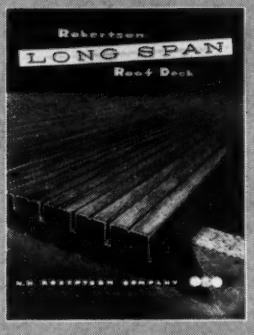

8

Write- for these free books from Robertson's technical library

1. Acoustical Data on Q-Deck: It has long been known that the fluted underside of steel deck provides some acoustical value, yet demand for more has led to this new low-cost method. Application details and test data are included.

2. An Analysis of Industrial Roof Construction: This valuable booklet compares all the better-known roof types (flat, monitor, bow-string, high-low bay, saw tooth) on the basis of structural steel, volume, roofing, sash area, flashing, ventilation and daylighting.

3. Design and Cost Factors of Structural Floor Wiring: This study compares Q-Floor with other conventional floor systems using underfloor duct. Based upon a typical multi-story building, the book is replete with charts and cost analyses of all structural components.

4. Daylighting Cost Analysis: This new and unusual study contains a questionnaire, which when properly filled out will reveal how quickly scientifically planned natural daylighting will pay for itself in a structure through savings in electricity. All data are substantiated.

5. New Composite Q-Floor Catalog: This newly revised catalog contains many examples of the latest Q-Floor buildings and a full exposition of Q-Floor advantages. Structural details and specifications are more complete than ever before.

6. New M-Type Q-Panel Catalog: Recent newcomer to the Robertson product family is the M-Type Q-Panel which possesses unique advantages over other types of modern curtain wall construction. The book contains 3 pages of structural details plus complete specifications.

7. New Long-Span Q-Deck Catalog: Another new Robertson product is this sturdy, yet exceptionally long-span deck. Easy to handle and erect despite its length up to 32 feet, it is especially designed for schools and supermarkets and other structures in which unbroken spans and a saving of structural steel is beneficial.

8. Ventilation Engineering Booklet: More than a ventilator catalog, this booklet not only describes products, but contains detailed tables of exhaust capacities, based upon average wind velocities, temperature differences and height above intake. Use the coupon below.

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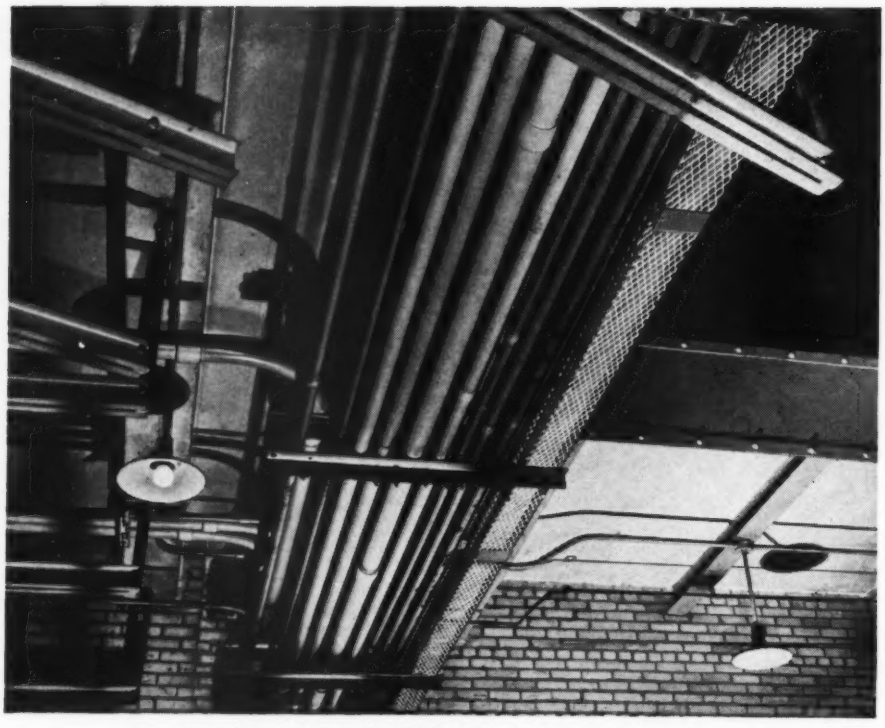


Jersey Central Power & Light Co., South Amboy, N. J. Burns & Roe, Engineers.
The Cope Cable Trough shown above carries as much cable as all of adjacent system.

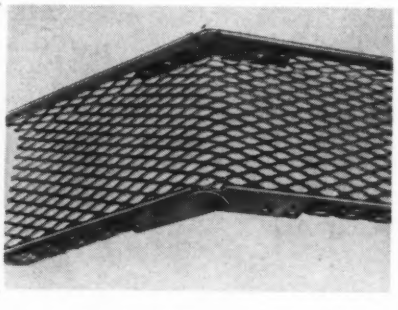
Jersey Central Power & Light Company Cuts Costs with Cable Trough

The great space saving possible with Cope Trough is dramatically illustrated at Jersey Central Power & Light Company's South Amboy installation of cable supports. Where space is at a premium, specify Cope Cable Trough.

SAVE LABOR during installation. Cope Cable Trough with the exclusive Pin-Type Coupler goes in faster than any other trough system. Standard fittings are available for virtually any connection, corner, awkward space—yet fewer individual pieces are needed and installation time is greatly reduced.

SAVE MATERIALS with Cope Cable Trough. You support far more cable with the same weight of Trough than with any competing system—and steel is costly.

Elevation changes are simple with Cope Trough. Edges of the Trough may be cut readily and standard fittings insure rigid support.



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Consulting Engineer European Tour

You, as a consulting engineer, are invited to join with a distinguished group of engineers in private practice who will visit Europe this spring to learn of the professional and technical activities of the most prominent European consulting engineers.

This will be a business trip. Arrangements have been made for you to meet in groups and individually with the most outstanding engineers in Europe. You can learn how they deal with architects and contractors, how they set fees, what new techniques they are using.

The trip will be by a Trans World Airlines regular flight. All air travel will be on scheduled flights so that all insurance applies and regular scheduled flight crews will be used.

The plane is scheduled to leave San Francisco, Chicago, and then New York on Monday, April 30. Slightly less than a week will be spent in each of four countries with the final eight days in France. The tour will return to the same U. S. cities on May 27.

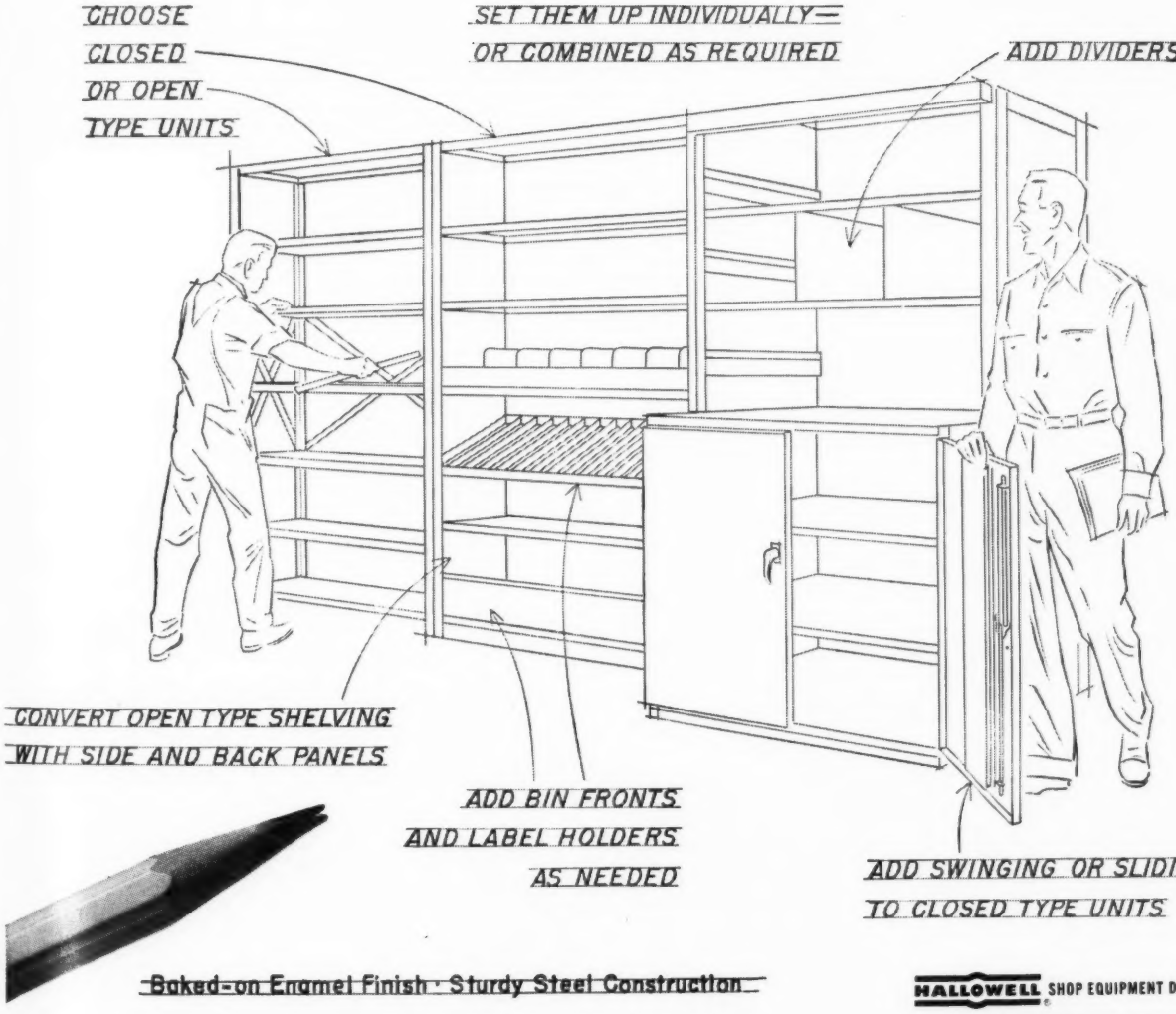
The tour is scheduled to go first to London and from there to Amsterdam, Frankfurt, Zurich, and Paris. In each of these locations there are outstandingly successful associations of consulting engineers. There will be side trips to points of engineering or general interest.

The basic cost for transportation from start to finish will be about $850.00. That is from New York. Add to that the fare from your selected point of departure to New York, and that will be the full cost for transportation.

As an estimate, you could get along nicely for about $1400 including everything except the gifts you bring home. It is likely that something like $1500 per person would be the figure to assure an easy and even flush trip. A couple would find that $3000 would move them about Europe in sheer luxury.

For further information write:
The Editors
CONSULTING ENGINEER
227 Wayne St., St. Joseph, Mich.

HOW TO USE HALLOWELL ADJUSTABLE SHELVING IN PLANT MODERNIZATION


CHOOSE CLOSED OR OPEN TYPE UNITS
SET THEM UP INDIVIDUALLY— OR COMBINED AS REQUIRED
ADD DIVIDERS
CONVERT OPEN TYPE SHELVING WITH SIDE AND BACK PANELS
ADD BIN FRONTS AND LABEL HOLDERS AS NEEDED
ADD SWINGING OR SLIDING DOORS TO CLOSED TYPE UNITS

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MEN IN ENGINEERING

New address of the Florida branch office of Michael Baker, Jr., Inc. is No. 1 South West 16th St., Fort Lauderdale, Fla.

Fred S. Dubin, head of Fred S. Dubin Associates, has been chosen as engineering consultant to the Governor's Committee on School Building Costs, by Governor Herter of Mass. The new consulting office at 45½ Mt. Auburn St., Cambridge Mass., will be managed by Peter Myers, Associate of the firm.

Dr. John G. Dean, chemical and metallurgical consultant, Tuckahoe, N.Y., has been retained by Climax Molybdenum Co. to advise on aspects of the company's recently expanded chemical program.

Robert F. Dean, mechanical engineer with Gibbs and Hill, Inc., has been awarded the honorary degree of Mechanical Engineer from Stevens Institute of Technology, Hoboken, N. J.

The American Society of Civil Engineers announces creation of the American Sanitary Engineering Intersociety Board made up of representatives from major national engineering and public health organizations. Co-chairmen are Prof. Earnest Boyce, of the University of Michigan Department of Civil Engineering and William A. Hardenbergh, president and editor of *Public Works Magazine*. Headquarters will be in the Engineering Societies Building, 33 West 39th St., New York City. Aim of the new body is to improve the practice of sanitary engineering and to grant certificates of special knowledge in the field.

Methods Engineering Council has appointed Robert O. Ferguson as vice president. H. B. Maynard, president of the Council, has been awarded an honorary degree of Doctor of Law from the University of Miami, at Coral Gables.

K. W. Reece has been appointed executive vice president of Ebasco Services, Inc.

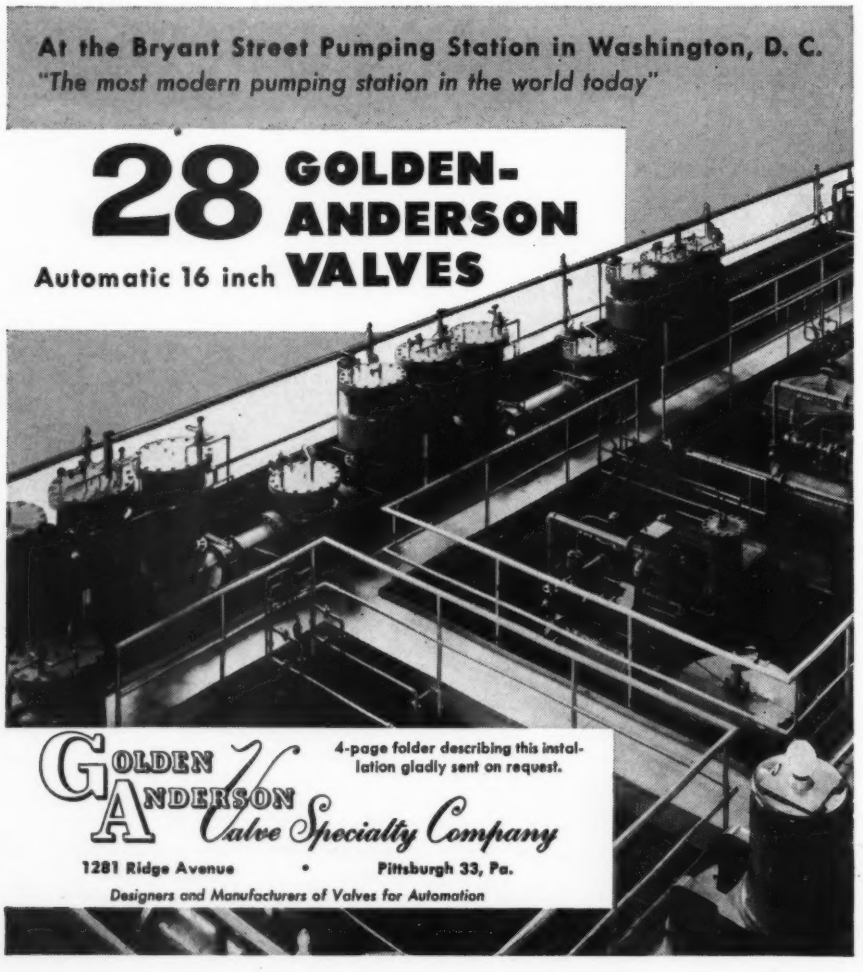
Amedeo Leone, vice president and secretary of Smith, Hinchman & Grylls, Inc., has been appointed a member of the City Plan Commission of the City of Detroit.

New officers of the Chicago Association of Consulting Engineers are: president, Charles R. Kuglin; vice president, E. R. Gritschke; and sec'y-treasurer, R. J. Houkal, Jr.

New officers of the Gulf Institute of Consulting Engineers are: president, George P. Rice; 1st vice president, Louis N. Goodman; 2nd vice president, Leo S. Weil; secretary-treasurer, George A. Heft. Members of the board, in addition to the officers, are Charles Butler, and B. M. Dornblatt.

Warner Howe, a partner in the firm of Gardner & Howe, Memphis, Tenn., has been nominated for vice president of the Southern Region of the National Association of Professional Engineers for a second term. Howe is a civil engineering graduate of Cornell University. Of the other nominees for executive office in NSPE 1956-57, three are employed by public utilities, two are engineering professors, one is with the government, and one is secretary of an association.

New president of the Association of Consulting Management Engineers, Inc. is Walter J. Semlow, president of Barrington Associates. The three new vice presidents are: John L. Burns, of Booz, Allen & Hamilton; G. Corson Ellis, of A. T.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Fenestra **MOVABLE** Fire Partition Panels...

2½-Hour Fire Rating . . . Easy Assembly

Now! A fire wall you can actually move from place to place as the need arises! Fenestra's new Movable Fire Partition Panels eliminate once and for all the problem of building (and relocating) masonry fire walls.

Use Fenestra* Fire Partition Panels to break up large open areas, for paint booths, inflammable storage or wherever else a full 2½-hour fire rated wall is needed. (We will be glad to send you results of a large-scale fire rating test conducted to ASTM standards at Ohio State University and witnessed by Factory Mutual Laboratories.)

Fenestra Fire Partition Panels are easy to erect and move. They're made like a sandwich, with two sheets of galvanized 18-gauge steel on either side of four ½" layers of gypsum-vermiculite board. Ideal for either new or existing buildings.

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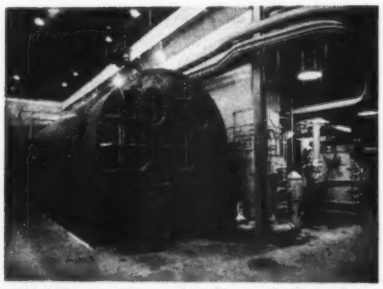
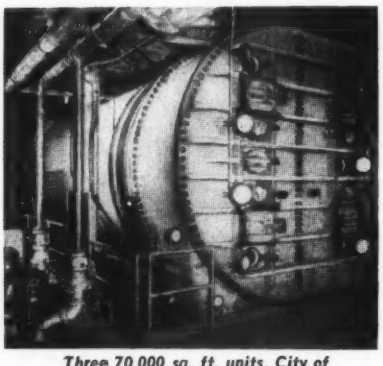
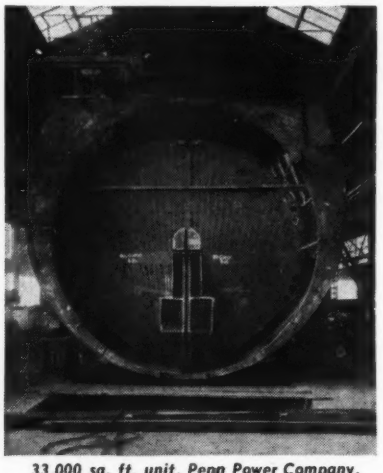


28,000 sq. ft. unit, City of Owensboro, Kentucky.

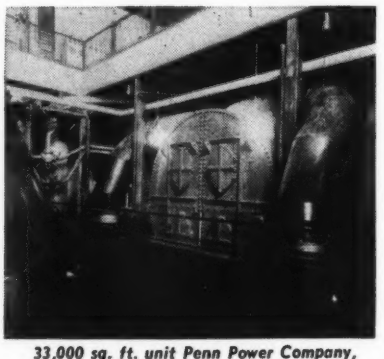


Three 70,000 sq. ft. units, City of Los Angeles, Cal.

One 45,000 sq. ft. unit and two 20,000 sq. ft. units, Puerto Rico Water Resources.



33,000 sq. ft. unit, Penn Power Company, Newcastle, Pa. Under Construction.



33,000 sq. ft. unit Penn Power Company, Newcastle, Pa. Installed.

OTHER INSTALLATIONS INCLUDE

One 30,000 sq. ft. unit, Northern Sate Power Corporation.
One 35,000 sq. ft. unit and three 12,000 sq. ft. units, for Dairyland Power Corporation.

UNDER CONSTRUCTION

One 45,000 sq. ft. unit for Transit Authority, N. Y. C.
One 35,000 sq. ft. unit for Maryland Power Corporation.
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Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

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Kearney & Co.; and Robert W. Kent, of Bigelow, Kent, Willard & Co. Secretary-treasurer is John F. Sengstack, of Scovell, Wellington & Co.

The March monthly meeting of the American Institute of Consulting Engineers, to be held at the Engineers' Club, New York City, Wednesday, March 7, at 12:30 p. m., will feature Captain John J. Albers (CEC), USN, as speaker. Captain Albers, officer-in-charge of the Texas Tower Project for Atlantic Offshore Bases, will describe this engineering development.

R. S. Noonan, Inc., York, Pa., has appointed George L. Aulbach as vice president of sales and engineering.

Fred S. Dubin Associates and Raymond Lowy have associated in New York for the practice of mechanical and civil engineering at 279 W. 14th St., New York and at 178 So. Whitney St., Hartford, Conn.

The Lummus Co. plans to establish an Engineering Development Center in Newark, N.J., early in 1956. The new facilities will be used primarily for pilot plant operation and process development work carried out in conjunction with Lummus' clients.

Mervin S. Coover, head of the Electrical Engineering Department, Iowa State University, has been nominated for the 1956-57 presidency of the American Institute of Electrical Engineers. Vice presidents nominated are: Donald E. Garr and Leland F. Stone, both from General Electric Co.; James H. Foote, Commonwealth Services, Inc.; Norman F. Rode, Texas Agricultural & Mechanical College; Mansfield M. Ewell, Westinghouse Electric Corp.; and Henry H. Kerr, Toledo, O., Edison Co. ▲▲

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 227 Wayne St., St. Joseph, Mich.

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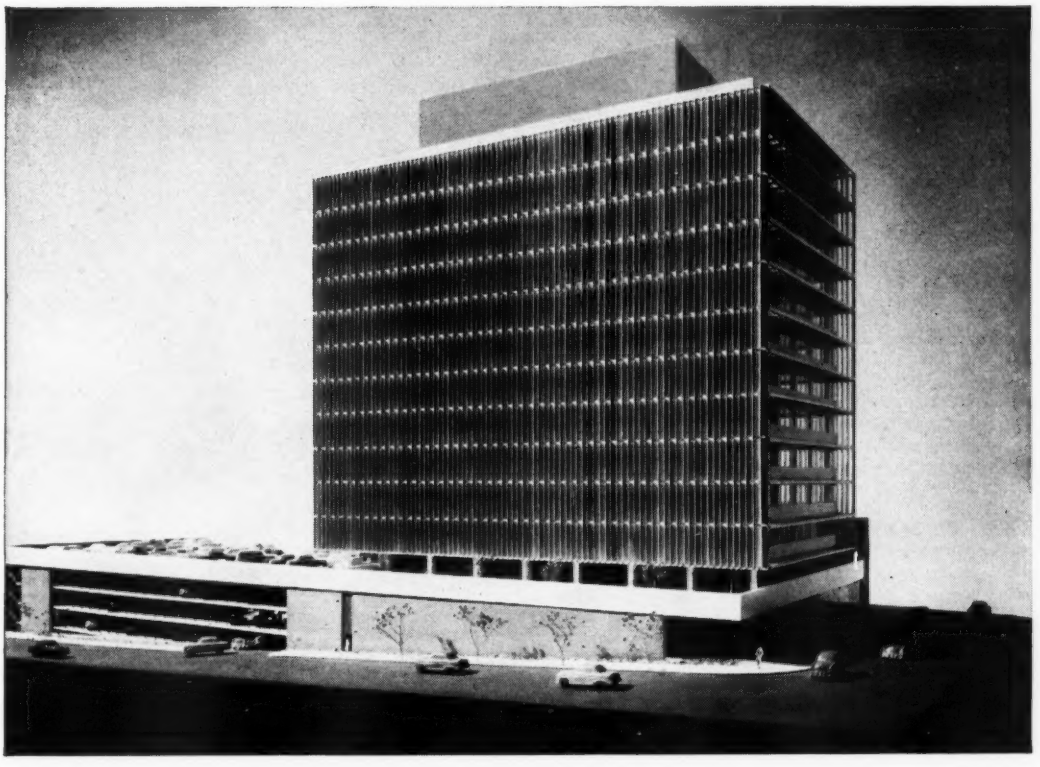
OWNER AND BUILDER: *Tishman Realty and Construction Co., Inc. New York and Los Angeles*
ARCHITECT: *Victor Gruen, A.I.A., Los Angeles, New York and Detroit*



serving the architect, and owner-builder
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This new 13-story office building will be completely air-conditioned. To admit maximum natural light without the discomfort of glare and direct sunlight, the building has been designed with projecting horizontal sunshades on the south and north elevation, and vertical louvers on the east and west elevation. The complete aluminum wall framing and vertical louvers will be Kawneer engineered and produced, saving the architect and builder months of time and giving them the assurance of client satisfaction. Special Kawneer weather-tightness plus expansion and contraction features will be included.

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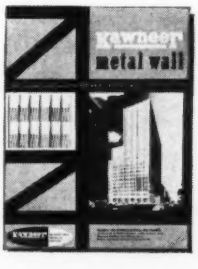

50TH ANNIVERSARY
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New Projects Reported

By Consulting Engineers —

ARKANSAS

Frank T. Tobey Jr. & Associates. Industrial building, 60,000 sq ft. Power, heat, air conditioning and ventilation, outside parking, and truck storage. Paragould, Ark., W. B. Thompson, electrical and mechanical engineer. $300,000. Client, Greene County Industrial Development Corp., Paragould, Ark.

CALIFORNIA

A. Epstein and Sons, Inc. Manufacturing building, Los Angeles, Calif. $1,000,000. Client, General Felt Co.

Albert C. Martin & Associates. Motor freight terminal in Los Angeles, Calif. to occupy 18 acres of a 35 acre site. Quarter-mile long Tow-veyor system with 2000 pallet-sized detachable carts. $1,500,000. Client, Pacific Intermountain Express Co.

COLORADO

R. W. Beck & Associates. Increasing city domestic water storage by raising an earth-fill dam with concrete core on North Fork of French Creek near Pikes Peak, Colo. Also preparation of engineering study for financing and municipal distribution system improvements. $500,000. Client, Manitou Springs.

Ramsey & Reeves. Housing development flood control channel and bridges, rip rap, etc., at Aurora, Colo. $800,000. Client, Morris Brothers Construction Co., Inc.

Harold Hoskins & Associates. Addition to existing sewage treatment plant and extension of facilities to include secondary treatment. $425,000. Client, City of Greeley, Colo.

Five miles of new watermain 4 to 10-in., Greeley, Colo. $110,000. Client, Greeley Northwest Suburban Water and Sanitation District.

Improvement district, paving asphalt, and curb and gutter. $200,000. Client, City of Sterling, Colo.

CONNECTICUT

Fred S. Dubin Associates. State Prison, Enfield, Conn.—complete new facilities for 1440 prisoners. $18,000,000. Client, State of Conn.

First Presbyterian church and school, Stamford, Conn. $1,170,000. Client, architects, Harrison & Abramovitz and Sherwood, Mills & Smith.

Westport Senior High School for 1800 pupils, Westport, Conn. $2,800,000. Client, architects Sherwood, Mills & Smith.

Jerome F. Mueller. Intensive treatment building (new), Norwich State Hospital (Mental Institution), Norwich, Conn. Mechanical and electrical engineering. $5,300,000. Client, Lester S. A. Julianelle, Architect.

FLORIDA

E. J. Kelly & Associates, Inc. Citrus concentrate plant, Haines City, Fla., materials handling, evaporation, refrigeration, processing. $700,000. Client, Stokely Van Camp, Indianapolis, Ind.

R. W. Beck & Associates. 16,500-kw addition to oil-fired steam power plant, Key West, Fla. $3,200,000. Client, City Electric System, Key West, Fla.

ILLINOIS

A. Epstein and Sons, Inc. Manufacturing, warehouse and office building, Chicago. $1,600,000. Client, Reflector Hardware Co.

Manufacturing building, Chicago. $1,000,000. Client, Interchemical Corp.

Apartment building (840 rooms), Chicago. $5,000,000.

INDIANA

E. J. Kelly & Associates, Inc. Cold storage warehouse, 600,000 cu ft, -10F buildings and refrigeration. $300,000. Client, Stokely Van Camp, Indianapolis.

Metropolitan Engineers, Inc. Indian Heights, Subdivision, Kokomo, Ind. $20,000,000. Client, Lusk Corp.

KANSAS

Wilson & Co., Engineers & Architects. Four-place B-52 hangar at Boeing-Wichita. $3,300,000. Client, Boeing Airplane Co., Wichita Div.

Industrial waste treatment plant at Boeing-Wichita. $750,000. Client, Boeing Airplane Co.

Servis, VanDoren & Hazard. Water distribution additions. $700,000. Client, City of Topeka, Kans.

Sewage treatment plant. $500,000. Client, Garden City, Kans.

MARYLAND

Herbert Manuccia, P.E., & Associates. Har Tzeon Synagogue, Old Bladensburg Road, Wheaton, Md. Structural design. $200,000. Client, Synagogue and Daumit & Sargent, Architects.

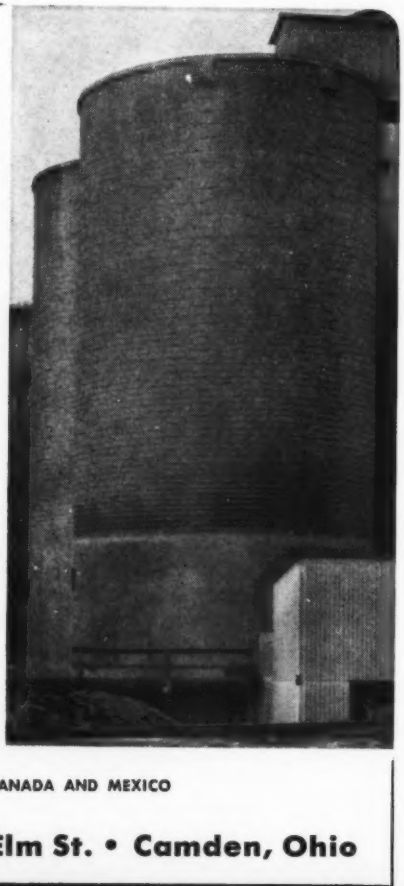
MASSACHUSETTS

Automation Management, Inc. Automated process for cleaning, inspecting, and packaging ocean clams. $40,000. Client, Cape Cod Shellfish Corp.

Fred S. Dubin Associates. Airmen's and officers' housing, Otis Air Base, Otis, Mass., 505 units. $6,500,000. Client, U.S. Air Force, architect, The Architects' Collaborative.

New England shopping center, Saugus,

2 of the 6 Neff & Fry Bins at National Gypsum



These two 30′ dia. x 66¼′ high bins are used by National Gypsum Co. at Bellefonte, Pa., for handling and storing raw lime from the kiln.

We've had experience in erecting bins and helping to design conveying systems for nearly 100 kinds of flowable bulk materials. This experience will prove valuable to you if you have such a project in mind.

There are many advantages in our type of bin construction. The outstanding feature is the Super-Concrete Stave with diagonal ends—dense and hard, does not spall or rust or burn.

Our folder, "Bins With the Strength of Pillars," is well worth a few minutes reading time. You are invited to ask for a copy.

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THE NEFF & FRY CO. • 302 Elm St. • Camden, Ohio

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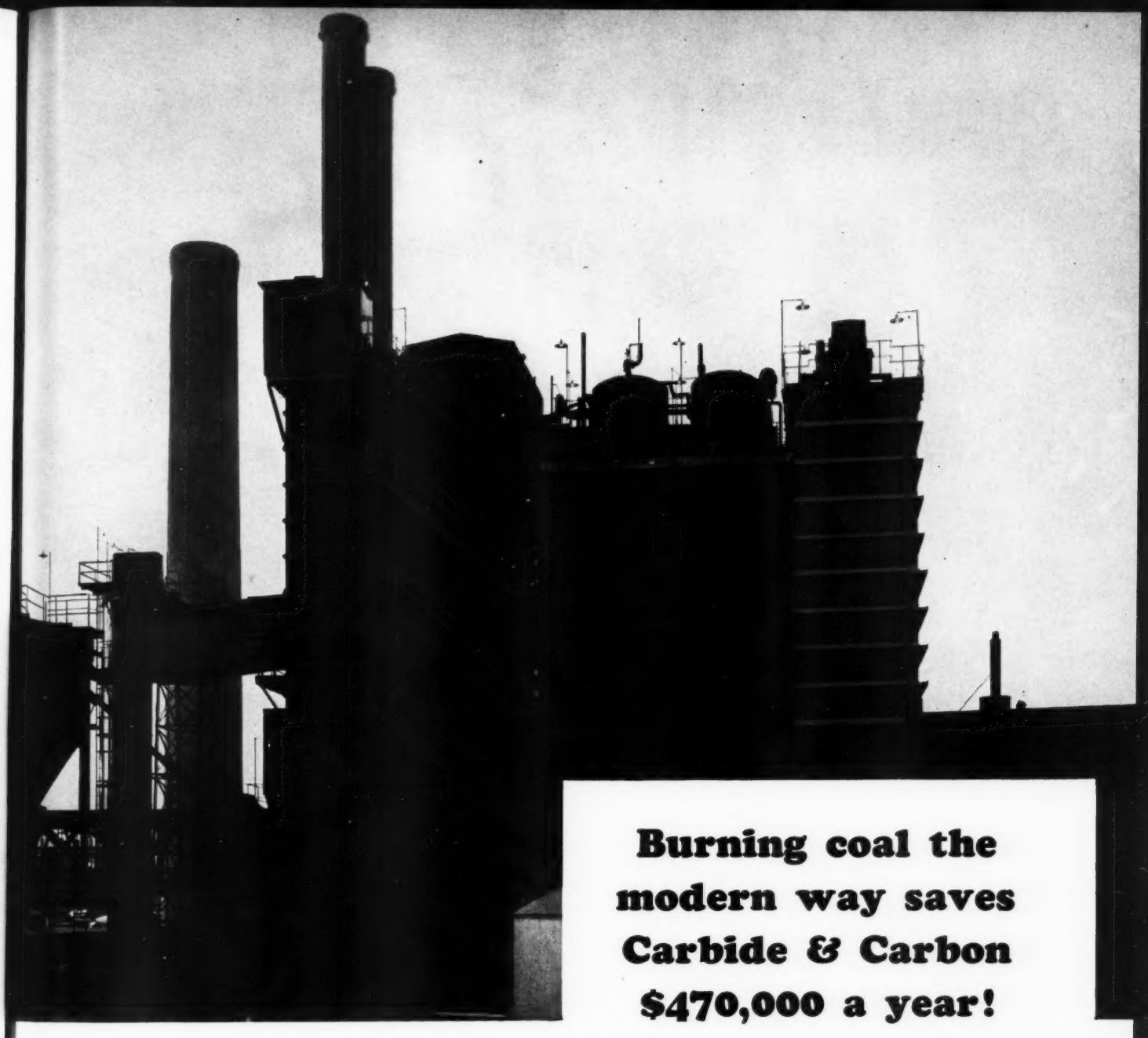

Burning coal the modern way saves Carbide & Carbon $470,000 a year!

Two years ago Carbide & Carbon Chemicals Co. instituted a modernization program in the power department of its South Charleston, W. Va. plant. Utilizing latest steam-generating techniques and equipment, the firm replaced an outmoded installation with a 289,000-lb.-per-hr. boiler fired with pulverized coal, and completely revamped the rest of its power system.

Today, this program has resulted in impressive annual savings. Lower fuel and maintenance costs save $85,000 . . . increased efficiency, $175,000 . . . flyash re-use, $10,000 . . . lower electrical power generation costs, $150,000 . . . lower manpower costs, $50,000—a total savings of $470,000 a year *plus* continuing power service dependability at Carbide & Carbon.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington, 5, D. C.

Note to consulting engineers

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

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is built into the
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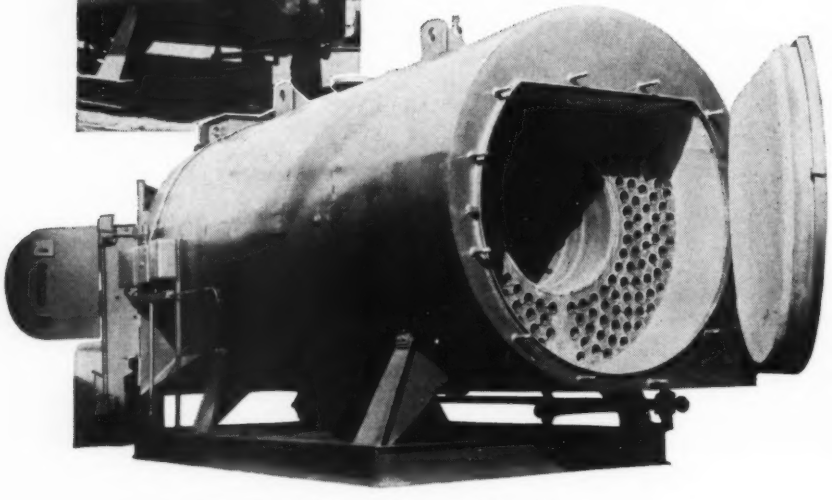
BOILER



. . . saves production time

. . . saves maintenance dollars

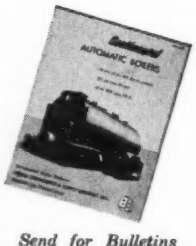
Rugged, simple in design, accessible—that's the Continental Automatic Boiler. Here are a few reasons why it's easy to keep this packaged steam generator at peak efficiency:

- Openings are provided to facilitate inspection of steam and water space.
- Both front and rear doors are hinged—affording quick access to furnace and return tubes.
- Cleaning, when necessary, is easy. One man can open both doors in a matter of minutes.

AND HERE'S WHY CONTINENTAL BOILERS STAY EFFICIENT FOR A LONG TIME:

- 2-pass design eliminates refractory baffles in front and rear which may burn out, leak and cause short circuit of gases.
- *All* return tubes are subjected to the same temperature and do equal work . . . and there is more uniform longitudinal expansion of the pressure vessel.

Used for high or low pressure steam and for hot water applications, Continental Boilers are fully automatic, range from 20 to 500 hp. and can be gas, oil or combination fired. Over 80% efficiency is guaranteed.



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BOILER ENGINEERING
and Supply Company, Inc.

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Mass., 476,000 sq ft, completely air conditioned. $8,000,000. Client, Milton Green Assoc., The Architects' Collaborative, and Ketchum, Gina & Sharpe.

Milo, Hart, & Goodoak, Inc. Report on Industrial Development, Burlington. $500,000. Client, D. B. Raymond, Inc.

Industrial plant—plans, specifications and supervision, Boston, Mass. $250,000. Client, Folding Box, Inc.

MICHIGAN

Yamasaki, Leinweber & Assoc. Institutional buildings: School, gymnasium, shops, dormitory, dining hall, infirmary, administration, staff housing. Southfield Township, Mich. $1,000,000. Client, Boys' Republic.

John C. Norton & Associates. Sewage treatment plant, three lift stations, six miles of sewers and interceptors. $250,000. Client, Village of Roscommon.

Jones, Henry & Williams. Sewage treatment plant. $440,000. Client, City of Albion, Mich.

New sewage treatment plant and intercepting sewer extension. $2,800,000. Client, City of Pontiac, Mich.

Steven Antonoff & Associates. Highway grade separation on Farmington-Brighton Expressway carrying US-16 (Reloc.) over Milford Road in Oakland County. $250,000. Client, Mich. State Hwy. Dept.

Highway grade separation on Farmington-Brighton Expressway carrying Old Plank Road over US-16 (Reloc.) in Oakland County. $145,000. Client, Mich. State Hwy. Dept.

MINNESOTA

Lindsey Engineering Co. New Sewerage system, waste treatment plant, and dairy irrigation treatment system. $170,000. Client, Village of Lester Prairie.

Curb and gutter. $23,000. Client, City of LeSueur, Minn.

A. Epstein and Sons, Inc. Coast-to-Coast Stores, Minneapolis warehouse and office building. $2,500,000. Client, Coast-to-Coast Stores.

Fred S. Dubin Associates. St. Johns Abbey & Monastary—new dormitory, church, science building, library, etc. —dormitory under construction, church in preliminary planning. $8,000,000. Client, St. Johns College & Abbey, Collegeville, Minn., architect, Hugh Stubbins Assoc.

Gausman & Moore, Inc. Highland Park Junior High School. 22 classrooms, auditorium, main gymnasium and two auxiliary gymnasiums, shower and locker facilities, cafeteria, kitchen, and administration area. General, mechanical, and electrical work. $1,800,000. Client, (owner) City of St. Paul, Board of Education, (architect) Hammel & Green, St. Paul, Minn.

Hitchcock & Estabrook, Inc. New Bio-Filter type sewage treatment plant. $250,000. Client, Wadena, Minn.

MISSISSIPPI

Irby Seay Co. Sewage collection lines and two treatment plants. $475,000.

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that can be better accomplished by instant transmission of visual information

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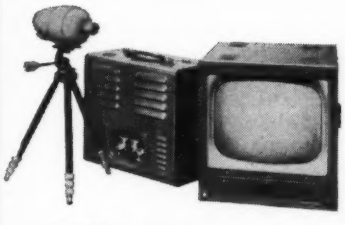
the closed-circuit television system that makes visual communication as easy as the telephone makes verbal communication.

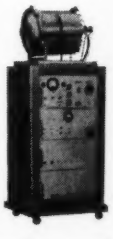


***ii-TV* Camera, control equipment and monitor, PD 150**

Highly sensitive camera needs minimum of light; weighs only 5 lbs. . . . fits into tight places; operates unattended. Available with weather-, heat-, shock-, and explosion-proof housings. Only camera is needed at pick-up location.

Controls and monitor can be located far away. Anyone can operate the system.

GPL Television Projector, PB 611, makes it possible for large groups to watch together. Provides bright, steady pictures. Control console is wheel-mounted for mobility. Does not require skilled operator. High quality sound circuits feed standard sound system.



Industrial Uses of Closed-Circuit TV

Industry has an important new tool—closed-circuit television. It is fast becoming indispensable to our working lives. This new tool enables you to see through walls, around corners, into spaces too cramped or too dangerous for human observers. It makes it possible for you to watch things, as they happen, in many different and remote places.

TV cameras can monitor anything from a single dial to every step in an entire assembly line. They can cover gates and aisles in factories and warehouses. They will keep an eye on restricted areas, loading platforms, railroad stations, car yards, airports. They are useful almost everywhere man moves about and works. Once the camera is mounted in place, it can be left unattended. Aim and lens adjustment can be controlled from a distance.

A closed-circuit system will present information to management in scattered offices without loss of time in traveling. It is a natural for sales demonstrations and training of scattered technical personnel. The camera will bring a person or group before as many audiences as there are TV receivers in the circuit. Installing a system between a central reference room and offices or laboratories makes it possible to visually consult remote information in a few seconds.

The GPL *industrial-institutional TV* System—GPL *ii-TV*—is outstanding closed-circuit equipment. It gives big, bright, clear pictures and its light requirements are minimal. Anyone can operate the entire system.

Camera, controls and receivers in the GPL *ii-TV* System are simple in design, economical to buy and maintain—and dependable. The entire system was developed and is being produced by one of the world's leading manufacturers of military, theatre, broadcast, institutional and industrial television equipment, General Precision Laboratory Incorporated, Pleasantville, New York. Write them for information.

Adv.

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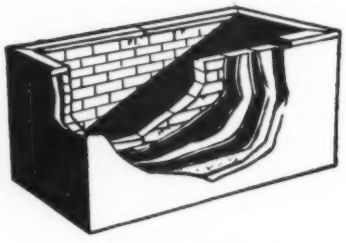
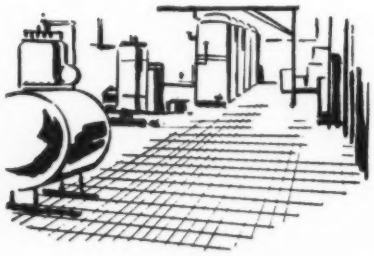
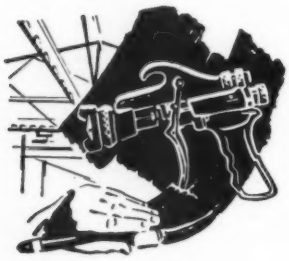
the most enduring way to ... STOP CORROSION



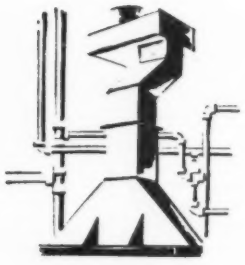
with ATLAS TANK LININGS for steel or concrete tanks. A complete corrosion-proof covering system from primer to protective brick sheathing.



with ATLAS CORROSION PROOF CEMENTS for the most severe conditions. Protection against acids, alkalies, salts, solvents and other corrosives.



with ATLAS PROTECTIVE COATINGS for almost every purpose. A complete line to assure the proper protective coating for the job.



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Tear out this ad and check the block where corrosion protection is most needed in your plant. You will receive a complete bulletin giving all technical information.

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TECHNICAL REPRESENTATIVES THROUGHOUT THE UNITED STATES

Client, City of Oxford, Mississippi.

NEW HAMPSHIRE

Parsons, Brinckerhoff, Hall & Macdonald. Design, specifications, and consultation during construction of two highway bridges on the Spaulding Turnpike, Dover, N. H. Client, New Hampshire Dept. of Public Works and Highways.

NEW JERSEY

Sauter & Castor. Riverside Metal Co. —Riverside, N.J. Housing and foundations for new machines. $100,000. Client, Riverside Metal Co.

A. Epstein and Sons, Inc. Warehouse, South Hackensack, N.J. $1,500,000. Client, Bigelow Sanford.

Nicolay Titlestad Corp. 450 ton/day sulfur burning, contact type sulfuric acid plant and related facilities. $2,500,000. Client, Dixon Chemical & Research, Inc., Newark, N.J.

Harry Terry. Westminster Choir College Dormitory for 150 students, Princeton, N. J. Selectemp automatic steam heat. 30,000 sq ft floor area. $500,000. Client, Fulmer-Bowers, Architects.

NEW MEXICO

Bridgers & Paxton. Federal building, Albuquerque, N.M., 300 x 100 ft, eight floors and basement. $6,000,000. Client, Gen'l Service Administration, architects, Flatow-Moore & Ferguson-Stevens.

Office building, Albuquerque, N. M. for Bridgers & Paxton. First commercial building in U.S. completely solar heated. $60,000. Client, Self.

NEW YORK

Benjamin L. Spivak. Hospital for Joint Diseases, New York, N.Y. Expansion of hospital facilities to include four new floors. $2,500,000. Client, Charles B. Meyers Associates.

Fred S. Dubin Associates. Temple Bethel, Poughkeepsie, N.Y. $300,000. Client, architect, Bertram Whinston.

Parsons, Brinckerhoff, Hall & Macdonald. Studies to determine the needs for design revision of existing sewage treatment plant. Client, City of Binghamton, New York.

OHIO

G. M. Goldsmith. Foundation for concrete mixing plant. $20,000. Client, Richter Concrete Corp., Cincinnati.

Store building, Cincinnati, Ohio. $30,000. Client, Hermes Brothers.

Stanley Engineering Co. Study to determine present water supply and demand for 4000 sq mi, northeastern Ohio area, estimation of population and industrial growth, and agricultural water requirements. Client, Lake Erie Watershed Conservation Foundation of Cleveland, Ohio.

Jones, Henry & Williams. New sewage treatment plant and intercepting sewers. $3,000,000. Client, City of Sandusky, Ohio.

Michael Baker, Jr., Inc. Lake Erie-Ohio River Highway through Ashta-

bula, Trumbull, Mahoning, and Columbiana counties, Ohio. Engineering report for approximately 100 miles of four-lane, limited access highway. $75,000,000. Client, Ohio Dept. of Hwys.

Eugene Herzog & Associates. Extension of high intensity runway marker lighting, Dayton Municipal Airport. $20,000. Client, City of Dayton, Ohio.

Frankenberger, Junker & Lensky. New warehouse, 15,000 sq ft. $150,000. Client, Emery Industries, Inc., Cincinnati.

Addition to Stillhouse. $100,000. Client, Emery Industries, Inc., Cincinnati, Ohio.

Fred S. Dubin Associates. Lake Erie College, Painesville, Ohio, new dormitory and social hall. $650,000. Client, Lake Erie College, Painesville, Ohio, architect, Christ-Janer.

Emmet J. McDonald. Schiller Storm Sewer Dist. No. 2, Cuyahoga Falls, Ohio. $150,000. Client, City of Cuyahoga Falls.

Fairway Estates, Akron, Ohio. Subdivision, sanitary sewers, storm sewers, paved streets, and water mains. $125,000. Client, M. G. O'Neil.

Yamasaki, Leinweber & Assoc. Research & development, chemical & metallurgical buildings, Euclid, Ohio. $1,100,000. Client, Thompson Products Co.

OKLAHOMA

Thomas & Marshall Engr. Co. Western Hill addition. Okla. City, Okla. Storm sewer max. dia. 54 in. Under construction. $70,000. Client, Western Hills Development Co.

Sanitary sewer laterals vitrified clay, 50% complete. $25,000. Client, Western Hills Development Co.

OREGON

Ray W. Preston, Electrical Engineer. Architectural and Arts Building. Electrical design. University of Oregon. $550,000. Client, Annand Boone & Lei Architects.

Eugene airport runway extensions. Electrical design. $300,000. Client, City of Eugene, Ore.

PENNSYLVANIA

Peter F. Loftus Corp. Power plant addition including one new steam generating unit, preaerator, boiler feed pump, etc. $175,000. Client, Altoona School District, Altoona, Pa.

Mast Engineering Co., Inc. Spring Township sewer collection system, covering four major developments in the township. $1,500,000. Client, Spring Township, Berks County, Pa.

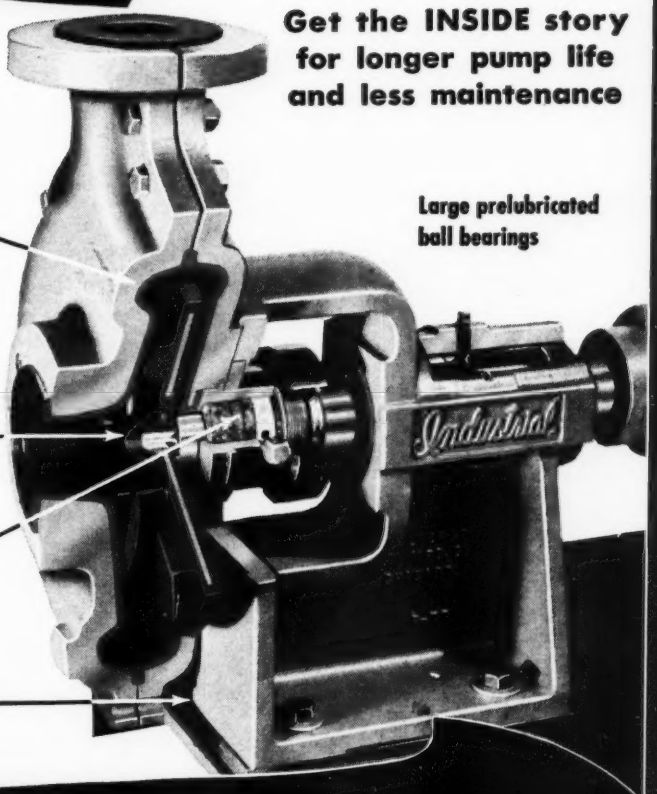
Roushey and Smith. New manufacturing plant with approximately 250,000 sq ft. Wilkes-Barre, Pa. Approx. $1,750,000. Client, Wilkes-Barre Chamber of Commerce and Eberhard Faber Pencil Co.

Fred S. Dubin Associates. Proposed Graphic Arts Co-operative Office Building, five stories, completely air conditioned, King of Prussia, Philadelphia, Pa. $3,500,000. Client, architect, Hugh Stubbins Assoc.

John Artim & Samuel O. Trautman. Catholic Church, Levittown, Pa. $150,000. Client, "Our Lady of Perpetual Help" Catholic Church.

Pumping Corrosives or Abrasives?

Get the INSIDE story for longer pump life and less maintenance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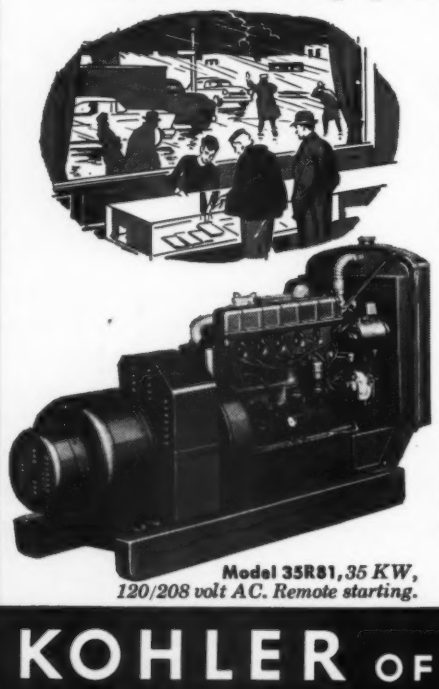
for stand-by protection before an emergency power stoppage



Storms or accidents may cut off central station power for days. Kohler stand-by plants automatically take over critical loads as long as needed. Cost is often less than losses caused by a single stoppage.

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Sauter & Castor. Six story concrete dormitory Moore School of Industrial Art, Philadelphia, Pa. $800,000. Client, Harbeson, Hough, Livingston & Larson, Architects.

Michael Baker, Jr., Inc. Reading distribution route. Bypass route around Reading, Pa. $8,000,000. Client, Pa. Dept. of Hwys.

Three-span steel truss bridge over Ohio River in Beaver County northwest of Pittsburgh. Spans will be 300, 1400, and 300 ft. Estimated cost $3,000,000. Client, Beaver County (Pa.) General Authority.

TENNESSEE

Sandberg-Serrell Corp. Engineering calculations of airstream contours for supersonic propulsion wind tunnel at A.E.D.C., Tenn. Client, Sverdrup & Parcel, Inc., St. Louis, Mo.

TEXAS

Blum & Guerrero Engineers. Steam and refrigeration central plant with 12,000 ton refrigeration capacity and electrical power and lighting for "the city within a city," Dallas, Texas. $8,000,000. Client, Exchange Park Co.

Thirteen story bank and office building for "the city within a city," Dallas, Texas. (first unit). $4,000,000. Client, Exchange Park Co.

Raymond L. Jenkins. Sharpstown Country Club, Houston, Texas. $1,500,000. Client, MacKie and Kamrath, Arch.

Sunnyside Grimes Jr. High School, Houston Independent School District. $1,800,000. Client, Emory White, Arch.

Reaves & Gregory. Arlington sewage treatment plant, construction of plant and installation of equipment. Plans in progress. $350,000 (est.). Client, City of Arlington, Texas.

Sewage treatment plant and sewage system improvements. Plans in progress. $750.000. Client, City of Corsicana, Texas.

Jones, Henry & Williams. Domestic water, sanitary, and storm sewerage for Harris County Water Control and Improvement District No. 50, Texas. $463,000. Client, Harris C.W.C.&I.D. No. 50.

E. B. Mansfield Co. Natural gas distribution system to serve the city of Junction, Texas. $200,000. Client, Junction Natural Gas Co.

VIRGINIA

Michael Baker, Jr., Inc. Private airport at Middleburg, Va. 3500-ft paved runway. $300,000. Client, Mr. Paul Mellon.

Wayne A. Becker. Three-unit swimming, diving, and wading pool, reinforced concrete, including filter plant, circulating system, marine lights, pool equipment, etc. $100,000. Client, Colonial Williamsburg, Williamsburg, Va.

Herbert Manuccia, P. E., & Associates. Denis J. O'Connell coeducational high school, North Arlington, Va. Engineering design. $2,800,000. Client, T. J. Collins & Son, Architects and Roman Catholic Church, Diocese of Richmond, Va.

Johnson & Williams. Sanitary sewerage system and sewage treatment plant

for Occoquan-Woodbridge Sanitary District-Prince William County, Va. $350,000. Client, Board of Supervisors, Prince William County, Va.

Parsons, Brinckerhoff, Hall & Macdonald. Contract drawings, specifications, and construction cost estimates for toll facilities at the James River and Nansemond River Bridges. Client, Virginia Dept. of Hwys.

Design, contract plans, and supervision of construction of a 35-mile long, divided four-lane highway for the Richmond-Petersburg Turnpike. Engineering survey and report. Client, Virginia Dept. of Hwys.

WASHINGTON

R. W. Beck & Associates. Economic feasibility report. Rocky Reach Hydroelectric Project. $200,000,000 (est.). Client, Public Utility District No. 1 of Chelan County, Wenatchee, Wash.

Sloane Associates. St. Edward's Seminary (Catholic), Lake Washington, Wash. Foundation soils investigation for new major Seminary. $3,000,000. Client, John Maloney, A.I.A., Seattle.

WASHINGTON, D.C.

Herbert Manuccia, P. E., & Associates. Beth Sholom Synagogue and school, 13th St., & Eastern Ave., N.W., Washington, D.C. Structural design. $800,000. Client, Synagogue and Daumit & Sargent Architects.

St. Thomas More school and convent, southeast, Washington, D.C. Structural design. $500,000. Client, St. Thomas More Roman Catholic church, architect, Frank Duane.

WISCONSIN

A. Epstein and Sons, Inc. Hospital, Milwaukee, Wis. $3,000,000. Client, Mt. Sinai Hospital.

WYOMING

Harold Hoskins & Associates. Drain, grade, and pave 6200 ft runway with improved lighting. $110,000. Client, City of Riverton, Wyo.

FOREIGN

Nicolay Titlestad Corp. 25 ton/day H_2S burning contact type sulfuric acid plant at first complete petroleum refinery in Puerto Rico being built for the Commonwealth Oil Refining Co. $750,000. Client, The Lummus Co., New York.

Porter, Urquhart, McCreary & O'Brien. Reorganization of Honduras Highway Department, including a training program and aid in the development of a road system throughout Honduras. $10,000,000. Client, Ministry of Development of the Republic of Honduras.

Michael Baker, Jr., Inc. Cambodian National Highway No. 4; 208 kilometer two-lane highway from new port of Gulf of Siam to Phnom-Penh. Also design for replacement of 24 war-destroyed bridges on National Highway No. 3. $15,000,000. Client, Ministry of Public Works, Govt. of Cambodia.

Fred S. Dubin Associates. American Legation Building, Tangier, Morocco, new building. $400,000. Client, U. S. State Dept., architect, Hugh Stubbins Associates.

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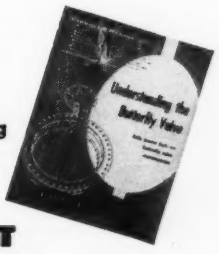

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consulting engineers' calendar

Date	Sponsor	Event	Location
March 7	American Institute of Consulting Engineers	Monthly Meeting	Engineers' Club New York, N.Y.
March 14-16	American Society of Mechanical Engineers	Aviation Division Conference	Beverly-Hilton Hotel Los Angeles, Calif.
March 19-23	American Society of Tool Engineers	Annual Meeting and Exposition	International Amphitheatre Chicago, Ill.
March 21	Illinois Institute of Technology and American Society of Mechanical Engineers	Lecture on "Vibration"	IIT Campus Chicago, Ill.
March 21-23	Illinois Institute of Technology and Armour Research Foundation	18th Annual American Power Conference	Hotel Sherman Chicago, Ill.
April 1-5	American Society of Mechanical Engineers	28th Annual Conference and Exhibit of the Oil and Gas Power Division	Jung Hotel New Orleans, La.
April 4	American Institute of Consulting Engineers	Monthly Meeting	Engineers' Club New York, N. Y.
April 9-12	American Management Association	Silver Anniversary National Packaging Exposition	Convention Hall Atlantic City, N. J.
April 10-11	Midwest Research Institute	Symposium for Management on Applications of Analog Computers	Hotel Phillips Kansas City, Mo.
April 17-19	Atomic Industrial Forum	Atomic Energy Conference	Atlanta, Ga. and Oak Ridge, Tenn.
April 18	Illinois Institute of Technology and Armour Research Foundation	Lecture on "Recent Developments in Structural Research"	IIT Campus Chicago, Ill.
April 19	Environmental Equipment Institute	2nd Annual Meeting	Sheraton Hotel Chicago, Ill.
May 2	American Institute of Consulting Engineers	Monthly Meeting	Engineers' Club New York, N. Y.
May 6-9	American Institute of Chemical Engineers	Meeting	Roosevelt Hotel New Orleans, La.
May 17-19	New York State Society of Professional Engineers	30th Engineering Industries Exposition and Annual Convention	Statler Hotel New York, N.Y.

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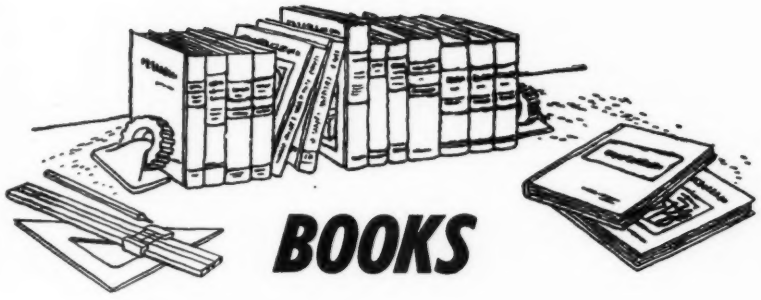

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ENGINEERING METALLURGY, by L. F. Mondolfo and Otto Zmeskal; McGraw-Hill Book Co., Inc.; 382 pp.; $8.00.

Reviewed by William R. Holman, Associate Physical Metallurgist Stanford Research Institute

This is an up-to-date introductory textbook written specifically for the undergraduate engineer who is not planning to take more detailed courses in physical metallurgy. Unlike many similar texts, it stresses the fundamentals, with emphasis on the underlying principles governing the behavior of metals and alloys. As in all survey courses, however, there is more information to dispense than the student has time to absorb. Faced with this fact, the authors have wisely chosen to de-emphasize, but not ignore, those phases of the subject which the engineer will pick up from handbooks or learn from experience.

The book dispenses with the subject of extractive metallurgy in the first chapter, where the whole field from mine to refinery is discussed. A brief introduction to crystals and the atomic structure of metals is then followed by a rather thorough treatment of phase diagrams and a short chapter on the structures and properties of alloys. With this background, the reader is exposed to several chapters on casting and plastic working before the subjects of solid state phase transformations and heat treating are taken up. Joining, powder metallurgy, and corrosion are then covered in short chapters, with a discussion of iron alloys and nonferrous metals concluding the book.

This is a well-organized and very clearly written textbook around which an interesting and worthwhile survey course in metallurgy can be given. Those who have studied the book will have a clearer understanding of metallurgy and its importance in all fields where metals are used. While the graduate metallurgist or consultant will find little new in the book, it is highly recommended to those who are unfamiliar with the subject.

●

PRINCIPLES OF INDUSTRIAL WASTE TREATMENT, by C. Fred Gurnham; John Wiley & Sons, Inc.; 399 pp.; $9.50.

Reviewed by Kenneth V. Hill Greeley and Hansen

This is a good treatise on the subject, containing something of interest and value to everyone who reads it.

The first 99 pages of the book present the author's (and others') views on waste treatment practice in general, the effect of wastes on streams and sewerage systems, and the criteria of pollution as related to the physical, chemical, organic, and biological characteristics of industrial wastes.

The next 240 pages deal with methods of treatment of industrial wastes, including physical treatment by sedimentation, filteration, and heat transfer; chemical treatment by pH adjustment; oxidation and reduction; coagulation and chemical reaction and absorption and ion exchange; and biological treatment by filtration, activated sludge, lagoons, and anaerobic digestion.

The remaining pages deal with: the ultimate disposal of treated wastes to receiving waterways, to land and to municipal sewerage systems; industrial waste surveys in a given industry; and with wastes from specific industries.

The book contains twenty-four chapters, each of which includes a liberal number of references to the technical literature.

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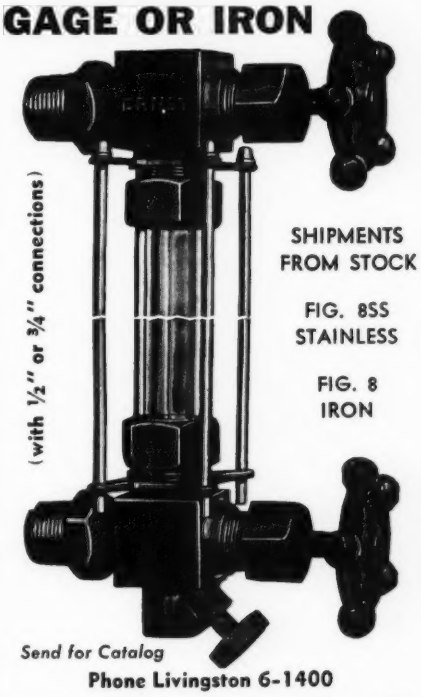

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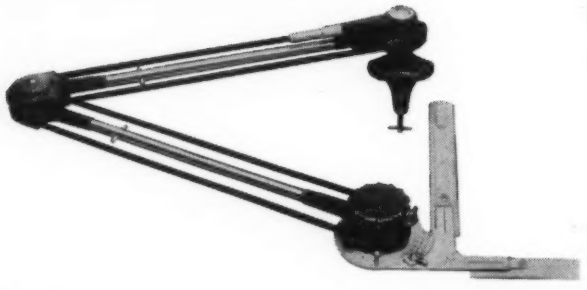

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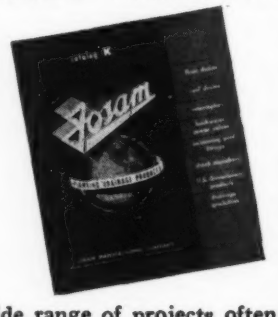

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